World Petroleum

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SAFE, FLEXIBLE, TWO-STRING

dual completions

with the Cameron Closed Pressure Method

Thousands of single zone and multi-zone completions, including dual concentric strings and dual parallel strings, attest to the soundness of the Cameron Closed Pressure Method of Well Completion. From the moment surface pipe is set until the well is tied-in for production, everything is under control. At no time is the well left open.

Latest development for multi-zone wells is the Cameron "DC" (dual completion) equipment for two parallel tubing strings. A unique tubing hanger design permits completion work on one producing zone entirely independent of the other zone. Triple seals on the hangers insure against pressures crossing over. Tubing strings may be run or pulled singly or together. The vertical run of the tree need not be oversize to accommodate the Cameron Type "H" Back-Pressure Valve. For example, a 2" Type "H" Back-Pressure Valve will pass through a 2" round opening valve.

Whether your needs call for single or multi-zone completion equipment, remember that Cameron is the industry's leader in drilling and completion control equipment. A Cameron man is nearby . . . ready, willing, and able to serve you!

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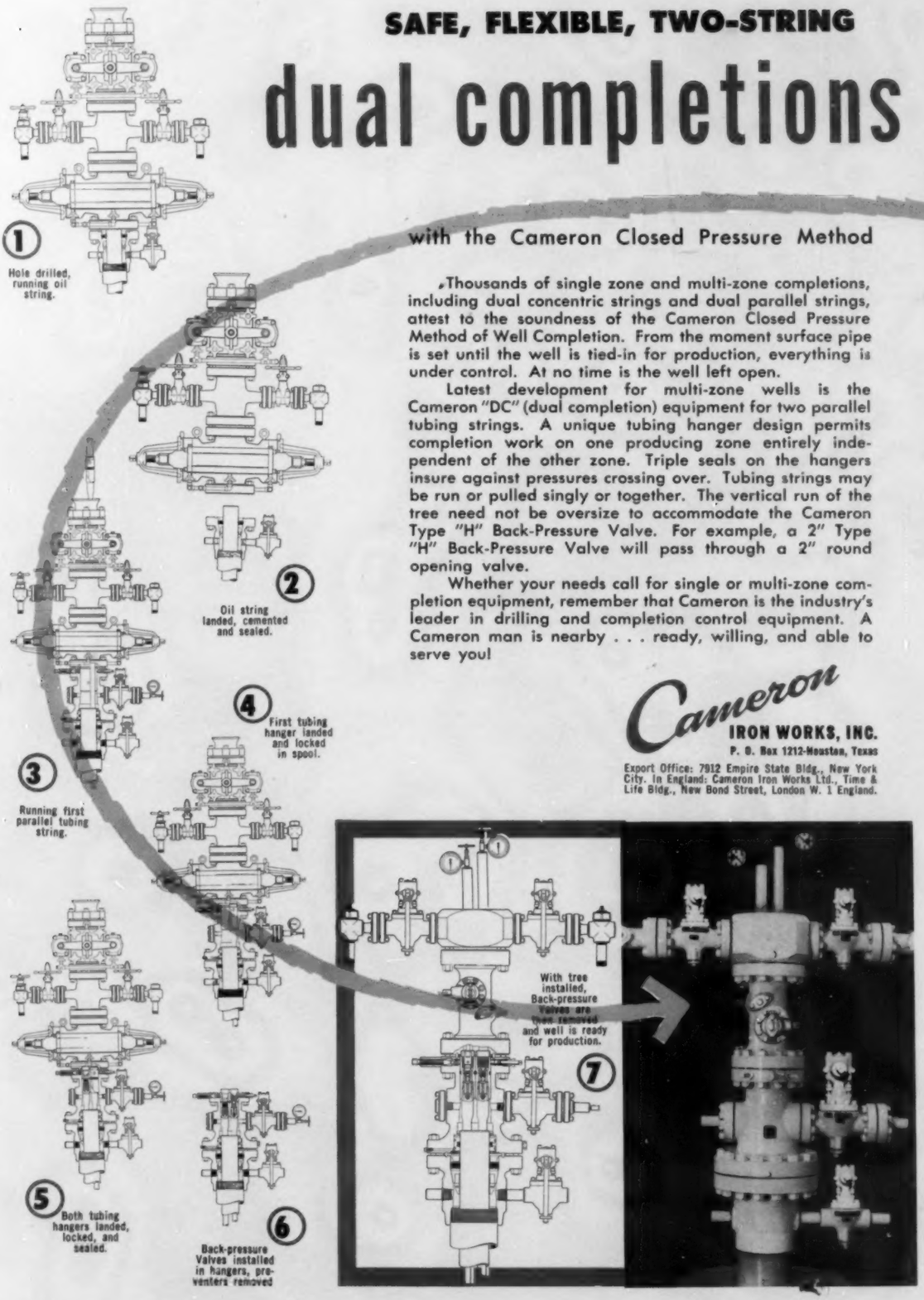
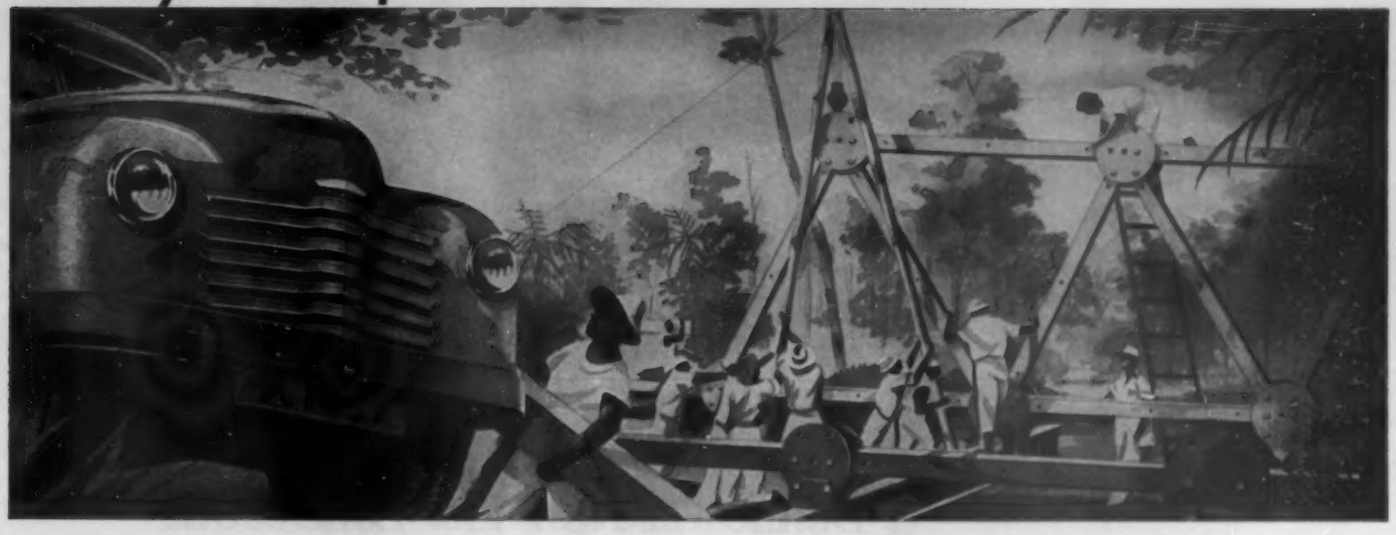
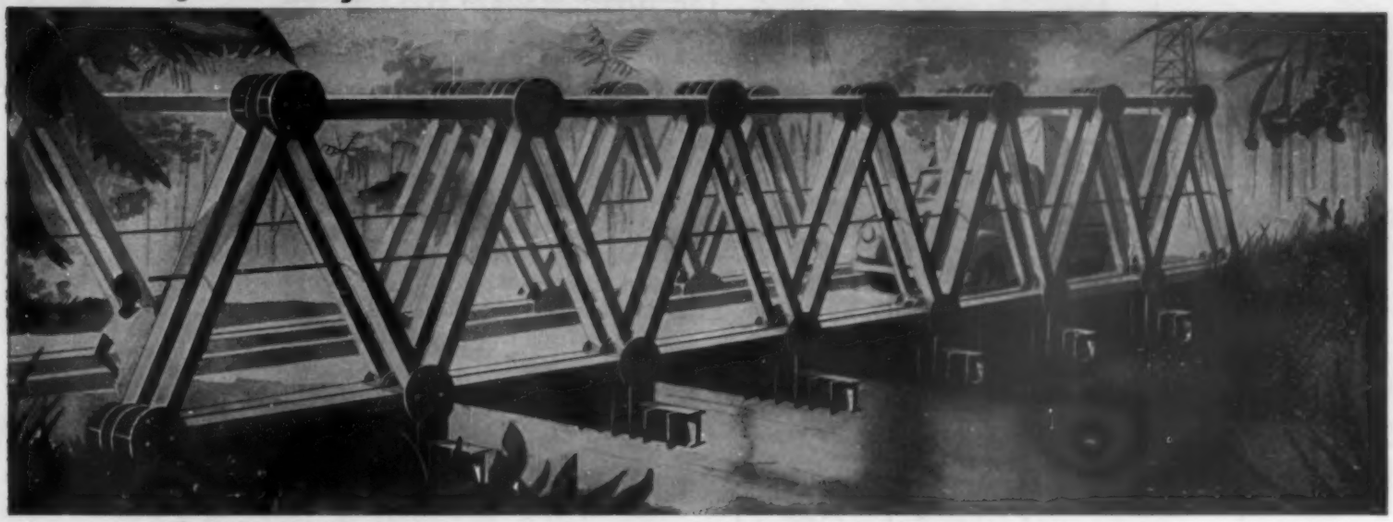

1
Hole drilled, running oil string.
2
Oil string landed, cemented and sealed.
3
Running first parallel tubing string.
4
First tubing hanger landed and locked in spool.
5
Both tubing hangers landed, locked, and sealed.
6
Back-pressure Valves installed in hangers, preventers removed
With tree installed, Back-pressure Valves are then removed and well is ready for production.
7

Easily transported to . . .



and quickly erected on . . .



remote up-country sites

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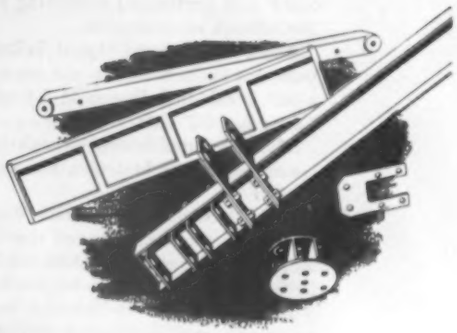

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McCullough Log Enables Precision Perforating of 5' Pay Zone

Discovers 8' Error in Electric Log and Casing Measurements

Operator of this old well ran an electric log which located a new, possibly productive, 5' sand.

McCullough was then called to run a Neutron Log. The Neutron curve confirmed the productive possibilities of the new zone, but also discovered that both the electric log and casing measurements were 8' in error.

The well was plugged back to 6800' and perforated according to McCullough measurements.

Thirty ½" improved Ogival Bullets were shot in the 5' sand in one run by a 3½" O.D. McCullough M-3 Gun. Casing was 5½" O.D. 17 lb.

The well started flowing through the casing before the M-3 Gun was out of the hole.

If the McCullough Radiation Well Logger had not discovered the 8' measurement error, the 30 shots would have missed the pay zone entirely.

It always pays to rely on the accuracy and dependability of McCullough's Radiation Well Logger.

McCullough Log Locates and Defines 11 New Pay Zones

Accuracy of McCullough Radiation Well Logger Permits Sharp Shooting of 11 Thin Zones for 138 B/D Increased Production

This was an old well in an established California oil field. Production had fallen to five barrels of oil per day.

Believing better production was possible, the operator decided to log and re-perforate the well. McCullough's combination Gamma Ray-Neutron Log was run from 4380' to 5645', locating several small, promising stringers of untried sands above the original pay zones.

A simultaneous collar log accurately located casing collars in relation to these thin sands, thus assuring "pin-point" accuracy in perforating.

The two original producing sands were re-shot, four holes per foot, with 26 improved ½" Ogival Bullets from McCullough M-3 Guns and with 26 McCullough Standard Casing Glass Jets.

Above these zones were the 11 small sand stringers ranging in thickness from 4 feet to 13 feet. Intermediate zones, lying between the productive sands, which were not to be perforated ranged in thickness from 5 feet to 103 feet.

Accurate measurement means "putting the shots where they count"... and the "pin-point" accuracy of the McCullough Radiation Well Logger makes sharp shooting of thin zones practical... assures uniform perforating coverage of any zone, thick or thin.

The 11 pay sands were perforated with 256 shots, four holes per foot, by 3½" O.D. McCullough M-3 Perforators firing ½" Ogival Bullets. Production increased from 5 to 143 barrels of oil per day.

This is only one of many actual jobs where the accurate, reliable, easily interpreted information provided by the McCullough Radiation Well Logger has located and defined multiple pay zones, tied-in casing collar locations and permitted precision perforating for best possible production.

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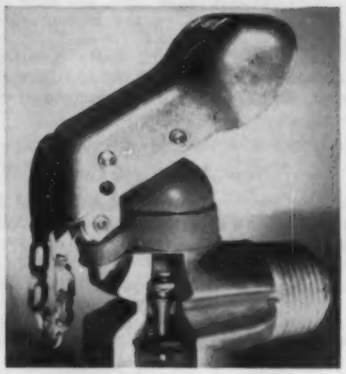

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Washington PIPE LINE

By Joseph B. Huttlinger

Both Republicans and Democrats are asking the support in votes and money, of oil interests in the election campaign which comes to an end in November.

Republicans say the Eisenhower Administration of the past four years passed submerged offshore lands legislation, eased up federal price controls over natural gas distributors, sold the government's wartime synthetic rubber plants, and suggested fair limits to oil imports. They claim they balanced the budget, cut taxes and ended wars.

The Republicans did fail, however, to complete the important bill to ease up federal price controls over independent producers of natural gas. Congress passed the legislation; the President vetoed it, due to "arrogant" lobbying.

Democrats, on the other hand, claim some of these measures were "give aways," and they are campaigning, partly, on this theme.

The Democrats promise to do more for the people, and less for business. Locally, Democratic candidates in districts with crude oil production, claim the Democrats in Congress preserve oil's depletion provision for income taxes, and have supported natural gas legislation.

The platforms of each party give some hints of thinking on oil and gas matters. Here is what the Republicans propose:

1—A long term policy covering minerals.

2—Imports of products, but not too much imports.

3—". . . reasonable depletion allowances." This is the same wording as in the platform four years ago.

4—". . . freedom of mineral producers from unnecessary government regulation." This is thought to mean a new natural gas bill.

The Republicans dropped from the platform of four years ago a plea for stepped-up government research on synthetic liquid fuels.

The Democratic platform suggests:

1—Imports, but not too much.

2—Conservation of resources for all persons.

3—Research on synthetic liquid fuel from coal, shale and agricultural products. The last is thought to mean research on gasoline from grain alcohol.

4—Policies to encourage exploration and development of new reserves of minerals. This is thought to imply support for an income tax depletion allowance.

Nine of the U. S. Senators up for reelection this year have voted for major measures supported by the U. S. petroleum industry, according to a study of the records.

They are:

Senators George A. Smathers, D., Fla.; Herman Welker, R., Idaho; Everett M. Dirksen, R., Ill.; Homer E. Capehart, R., Ind.; Bourke B. Hickenlooper, R., Iowa; Russell B. Long, D., La.; John Marshall Butler, R., Md.; Olin D. Johnston, D., S C.; and Wallace F. Bennett, R., Utah.

They voted right, as far as oil men are concerned, on two bills to restore state title to the offshore lands; bills to ease up federal price controls over natural gas producers and distributors and sale of the government rubber plants to private industry.

Seven of the men up for reelection voted against the views of the oil men on all these matters. They are Senators Lister Hill, D., Ala.; Thomas Hennings, D., Mo.; Wayne Morse, D., Ore.; Francis Case, R., S. D.; George Aiken, R., Vt.; Warren Magnuson, D., Wash.; and Alexander Wiley, R., Wisc.

The Senators voting for measures supported by oil, also voted against a proposal some years ago to slash the depletion provision for income tax purposes from the present 27.5% to 15%. Nine other Senators voted to slash the allowance, but none are up for reelection to the Senate this year. One of the nine is retiring this year; a second was defeated some years ago; a third is dead. The other six are still in the Senate. They are Senators Paul H. Douglas, D., Ill.; Theodore F. Green, D., R. I.; Hubert Humphrey, D., Minn.; Estes Kefauver, D., Tenn.; John O. Patore, D., R. I.; and John J. Williams, R., Del. Kefauver is the candidate for vice-president on the Democratic ticket

New Antitrust Case

Antitrust attorneys in the Department of Justice are pressing for a go ahead to bring a new oil price antitrust case before a federal grand jury. They have eyes on the "market leader" idea.

The Federal Trade Commission, meanwhile, is in final stages of its new price discrimination complaint against one or more major oil companies. Aid to dealers during price wars, in form of cut rate prices or rebates, is under attack.

FTC is opening hearings, meanwhile, into overriding commissions paid major oil companies on sale of tires at their gasoline stations on Oct. 15. FTC says the commissions are an unfair trade practice, bring pressure on dealers to handle one brand of tire only; oil companies say the commissions, amounting to millions of dollars a year, are for "normal" sale efforts.

Lobbying Investigation

A special Senate committee is studying means for tightening and clearing up lobbying laws. The special committee has until January 31, 1957, to make its report.

The committee was created after Sen. Francis Case, R., S.D., told the Senate this year he was offered a $2,500 campaign contribution by persons in favor of the Harris-Fulbright natural gas bill. The committee has held several hearings into the lobbying for and against the gas bill, and plans to veer into other lobbying later this year.

The hearings on the gas bill lobbying included these:

1. On May 1, 1956, Maston Nixon of Corpus Christi, chairman of the General Gas Committee, told how the committee was formed, that it had 667 members, that the members contributed $118,625. The GGC was identified later as a lobbying group.

The four top contributors, each giving $3,855, the records showed, were Humble Oil and Refining Co.; The Texas Co.; Magnolia Petroleum Co.; and Standard Oil Co. (Ind.).

2. On June 14, L. F. McCollum of Continental Oil Co., chairman of the Natural Gas and Oil Resources Committee, said his committee was for "education" and not chiefly lobbying, that it collected $1,972,545.58 for its work, and that many of the companies contributing wrote off the contributions as business expenses for income tax purposes. Top contribution came from Humble, $175,000. Baird Markham, director of the committee, and Paul Kayser of El Paso Natural Gas Co., vice-chairman of the committee, were others testifying at this session.

3. On June 21, John Heyke, chairman of the Council of Local Gas Companies, said it had registered lobbyists, collected some $37,000 for the fight against the bill, and spent $27,000.

4. On September 10, 1956, a three-day hearing opened where a parade of some 25 executives of oil and gas companies told the committee they had fought for the gas bill, that some companies had registered lobbyists, that had deducted as business expenses contributions to the McCollum committee, but not to the Nixon committee.

The hearings then closed until October 8. Then, the committee hoped to wind up the oil and gas phase, and delve into lobbying for other types of legislation.

Surprise in the September hearings came when officials of Standard Oil Co. (Ind.) admitted sponsoring a telegram campaign, at the cost of $1,500, to persuade Sen. Edward Thye, R., Minn., to vote for the bill. Some of the telegrams, officials admitted, were "spurious" in that company salsmen sent them and signed the names of others, without even getting permission of the alleged signer. About 900 telegrams were received by the Senator, who voted against the legislation.

A second development came to light with public release of a letter from O. Gordon Delk, acting commissioner of internal revenue, saying he was studying operations of the McCollum committee. If he finds, he said, that a principal purpose was lobbying, then contributions are not deductible.

While the hearings have been attracting headlines over the country, they have turned up little news; they have turned up few facts to indicate improper conduct by oil and gas. Even the signing of fake names, which is condoned by none, was explained as due to someone being too "eager", rather than to company policy.

Witnesses at the September hearing, most of them under subpoena and sworn in, included some of the most powerful men in the industry. A few of the names: Frank Prior, president, and other officials of Standard Oil Co. (Ind.); A. L. Nickerson, president, John J. Scott, general counsel, and Ray C. Hinman, legislative representative for Socony Mobil Oil Co.; T. S. Peterson, president, and Woolen H. Walshe, legislative representative, of Standard Oil Co (Calif.); Sidny A. Swensrud, president, and Archie D. Gray, general counsel, of Gulf Oil Corp.; Hines H. Baker, president, Walter F. Woodul, legislative representative, Nelson Jones, general counsel, and Herman Pressler, a director, all of Humble Oil and Refining Co.

New Conservation Study

The price effects of crude petroleum and natural gas conservation shape up as a subject Congress may study again next year.

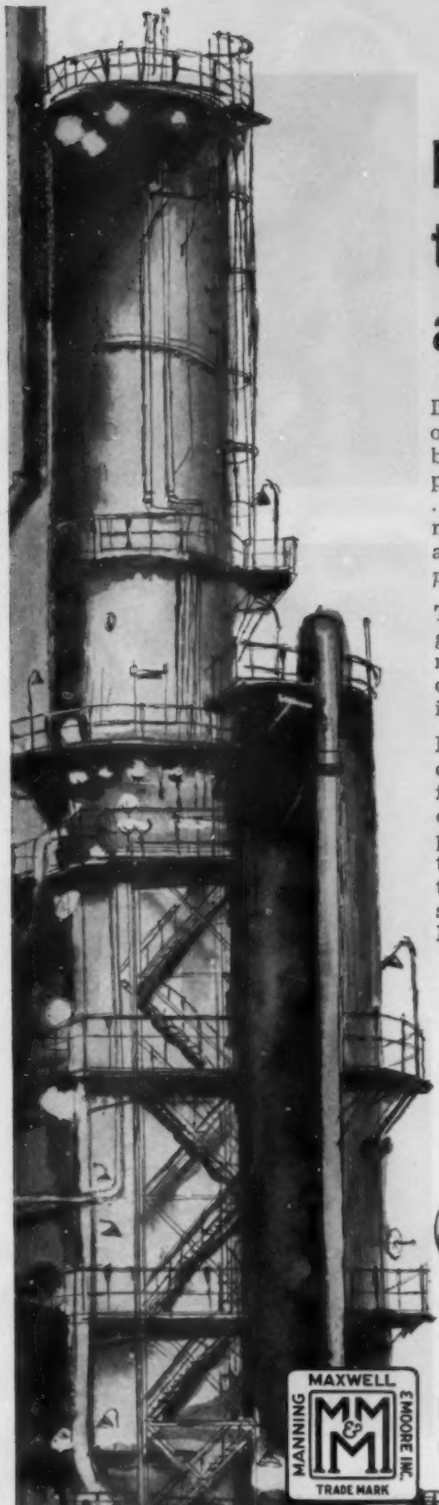
The prospect is strengthened by a new report from Attorney General Herbert Brownell, Jr., on the Interstate Oil Compact Commission.

Under order from Congress, Attorney General Brownell made a 94-page statistical review of the compact and how it came into being. Attorney-General Brownell shied off from the main purpose of the study—whether conservation goes in for price fixing. Annual reports are asked by Congress.

The prospect of Congressional study lies in the assertions in the report that Department of Justice did not want to make the study in the first place; that the DJ is not the proper agency to make such a factual study; that the study would need a tremendous appropriation; and that some other agency is the one to handle a matter like this.

Chances are, Brownell will try to get off the hook next year by asking Congress to give the job to the Federal Trade Commission.

The report is the first of its kind. It has a Sept. 1, 1956 date. Copies may be made by writing the Department of Justice and asking for the report on the Interstate Compact to Conserve Oil and Gas.



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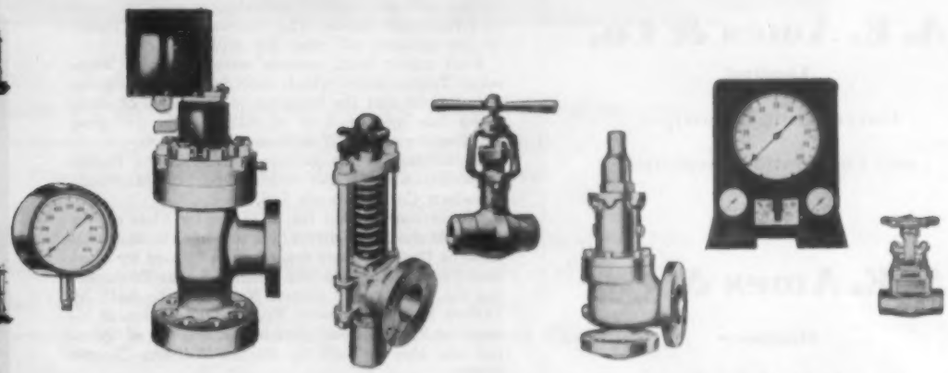

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Canadian Notes

British Columbian Activities Expand

Natural gas has become a reality in British Columbia's populous lower mainland areas as first the rural areas of the Fraser Valley and then the city streets of Vancouver have been torn up for the installation of the natural gas pipelines that will bring gas from the Peace River district to the coast.

Although the Westcoast Transmission line from Peace River will not be completed until next year, natural gas will be used in Vancouver and the lower Fraser Valley in November through a hookup with the Pacific Northwest Pipeline Corp.'s lines at the international boundary at Sumas.

With more than 475 miles of pipe already delivered and 200 miles laid by crews laying about a mile per day, the 650-mile Westcoast line is right on schedule.

Drilling in the Peace River area has been intensified since work started on the pipeline. The new drilling program has yielded oil showings in the Fort St. James area south of the Fort St. John gas fields. Pacific Petroleums, parent company of Westcoast, struck oil in a well being drilled in the permo-Pennsylvania formation. The new Pacific well is called Pacific Fort St. John No. 45 (LSD 9-19-83-18,W6). There was a 5,700-foot recovery of clean oil (40° to 43° A.P.I.).

Another field is being drilled by the Northern Foothills Agreement Group which consists of Texaco, Shell, Canadian Gulf and Mobil oil. Three commercial wells have been found 25 miles northeast of Fort St. John. They are capable of producing 240 b/d and are completed and awaiting marketing of their oil.

British Columbia's regulations covering oil and natural gas may be making a secret of further oil discoveries. An oil company which announces an oil discovery loses its preferred position in a highly competitive field. Under British Columbia regulations a company announcing an oil find is compelled to change to a lease status which turns over much of its oil land to the provincial government which puts the lands it gets up for bids. The original permit holder can reclaim the land only by paying up to 90% of the highest bid. With natural gas a company can declare a gas find and keep all its land.

The first refinery to process Peace River crude oil has been bought by Pacific Petroleums. The X-L Refineries at Dawson Creek were purchased in late August and will be operated in conjunction with the $20 million Peace River gas processing plant which Pacific and Westcoast Transmission are building at Taylor Flats on the pipeline route.

This plant will clean the natural gas from the Peace River fields before it enters the pipeline. Production from the plant will include sulphur, propane, butane, natural gasoline and other hydrocarbons.

The Dawson Creek refinery can handle 3,000 b/d and will process oil recently discovered in British Columbia by Pacific Pete and other firms.

Pacific Petroleums has staked eight new well sites in northeastern British Columbia's Fort St. John area as part of its $60 million 70-well field development program being undertaken to supply gas to Westcoast. The Fort St. John gas field covers an area of 100,000 acres and has one dozen productive horizons of which the Triassic and permo-Penn formations are considered the predominant gas reservoirs.

Distribution facilities for natural gas continued to take shape in August when two new distribution franchises were awarded by the British Columbia Public Utility Commission. Vancouver Island Natural Gas Co. was given permission to install and operate a $1 million gas utility in the island city of Nanaimo. Installation will be in charge of J. M. Pryde and Co. of Calgary. Company officials say gas will be delivered by January 1, 1957.

Inland Natural Gas was given authority to build a natural gas stub line from the Westcoast trunk at Prince George to supply gas to the Prince George Gas Co. Inland officials say the award cleared the last obstacle to its line down through the interior of the province which will supply the Okanagan and Kootenay region. The interior line and distribution systems will cost $30 million.

Four major work awards were made by Westcoast Transmission which includes three compressor stations and the building of 155 miles of gathering line system. Cost of stations and gathering lines will exceed $27 million.

Installation of the gathering lines in the British Columbia-Alberta gas fields went to Morrison-Knudsen Co. of Canada Ltd.

Compressor station No. 1, at Taylor Flats on the banks of the Peace River was awarded to Marwell-Stearns Roger, a joint organization formed by Marwell Construction Co. and Stearns Roger Engineering Co. Compressor station No. 3 will be built by Dutton Williams-Stearns Roger. This station is located at Fort McLeod. Station No. 5, south of Quesnel will also be built by Dutton Williams-Stearns Roger.

In Vancouver Imperial Oil will spend $4 million on gasoline-making equipment at Ioco refinery. A. G. Stewart, refinery manager, said tenders have been called for a powerformer, storage tanks, piping, fire protection equipment, roads and special equipment for handling the catalyst.

The powerformer will have a daily capacity of 5,000 barrels. Work on the main units which were designed by Imperial engineers at Sarnia, Ontario, will start soon after the contract is awarded. They should be ready to go on stream by summer of 1957.

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Shell of Canada Appointments

G. L. GARDINER, for 14 years manager of the Shell Oil Co. of Canada's refinery at Shellburne, B. C., near Vancouver, has been appointed general assistant to the vice president of the company's manufacturing division. DR. G. A. LORENZ, formerly assistant manager of the company's Montreal East refinery will succeed Mr. Gardiner at Shellburne.

Fred Brechtel

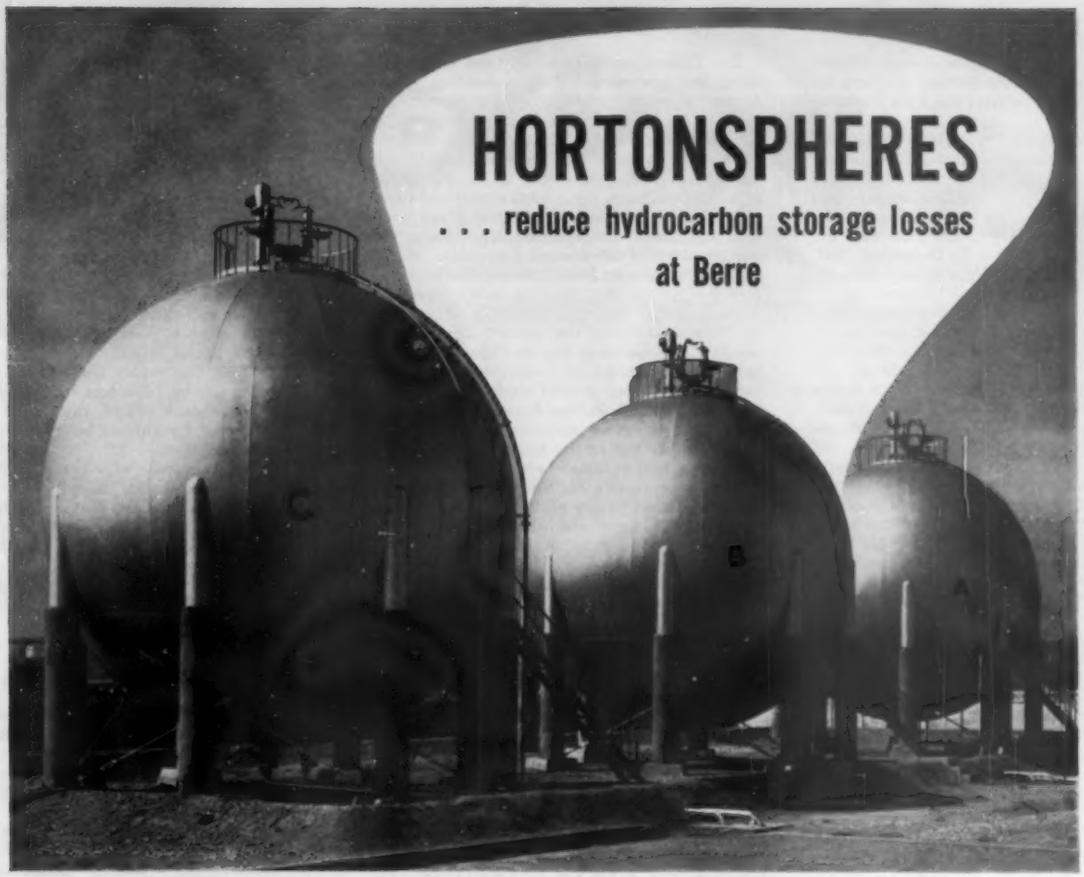
Jerald Alliger

Richard Hughes

Personnel Changes at Geophoto

Jerald Alliger, formerly manager of Geophoto Services, Ltd., Canada, has been transferred to Ankara, Turkey. Upon completion of his Turkish assignment he will be assigned to Geophoto's Denver office as manager of production control. Fred Brechtel, formerly administrative geologist, Calgary, is now manager, Geophoto Services, Ltd. Richard Hughes is now administrative geologist, Calgary.

Robert Anderson, chief geologist, has finished a four-months' assignment in Madrid, Spain, and has been transferred to Tripoli, Libya, for a short period before returning to Denver. Paul Fuenning, administrative geologist, Denver, recently received Geophoto's first 10-year employee award. He is Geophoto's first employee, having joined the firm on August 19, 1946.



Three Hortonspheres®, structures designed and erected to withstand internal pressure, are reducing evaporation losses of volatile hydrocarbons stored at the Butagas plant in Berre, France. No vapor can escape from these Hortonspheres as long as the settings of the pressure relief valves are not exceeded.

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Latin American Oil News

Lacq Gas for French Petrochemicals

Oil and gas executives and government officials in France are showing a lively interest in plans for commercial production of natural gas from the Lacq field.

The field, in southwestern France, was discovered by the Société Nationale des Petroles d'Aquitaine, a state-controlled company. In 1949, when a shallow oil field was discovered at a depth of about 1,800 feet, reserves were about 14 million barrels of crude. More important, the discovery touched off new interest in the search for crude oil. In December, 1951, deeper drilling found a natural gas deposit directly below the oil field.

A blowout occurred on discovery and the gas blew wild at the rate of 8,750,000 cubic feet per day. It was stopped only after two months of effort by Myron Kinley of Texas, a fighter of a wild oil and gas wells. Corrosion action of the gas, which had a hydrogen sulfide content of 18%, plus high bottom hole pressure, were given as reasons for the blowout.

Since then, efforts have been underway to handle the gas, despite the corrosive features. At times, the battle was almost dropped. With added wells, minimum reserves are estimated at 100 billion cubic meters (3.5 trillion cubic feet) of natural gas.

Recently, a special alloy steel was tried out, apparently with success. Lacq Well 102 was put into test production in September of last year for four and a half months. Indications are the special tubing can handle the gas.

Now under production is the first desulfurization unit, which will be capable of treating one million cubic meters (35 million cubic feet) of gas daily. The unit is to be completed in 1957.

The plant will have an annual production of 200 million cubic meters (7.06 billion cubic feet) of dry gas; 70,000 tons of sulfur; 12,700 cubic meters of gasoline; 4,200 tons of butane and 3,200 tons of propane.

After this, plans call for construction of an additional unit with a processing capacity of three million cubic meters of wet gas daily. An eventual processing capacity of 10-12 million cubic meters per day is reportedly envisaged for 1962. If this is reached, the Lacq field will be operating at 10 times the 1955 gas volume.

French officials see the field as the basis of a petrochemical industry. Thus, the by-products that could be produced include acetylene, methanol, formaldehyde, urea and polyvinyl. These could be the basis for the production of plastics, synthetic fibers, fertilizers, synthetic rubber and other products.

Offset Well Hits in Costa Rica

Stanley Martin, Union Oil Co. of California official, recently announced that on August 29th, their Cocolas No. 2 well near the Panama border in Costa Rica had "excellent shows of high quality" at 4,900 feet. Later tests indicated 1000 b/d.

The well blew for thirty minutes before being shut down, fifteen minutes of which was oil flow. Flow tests will be made to determine the extent of the deposits.

Cocolas #2 is one kilometer (about one-half mile) from Cololas #1, which had had oil shows at 5,500 feet and 6,500 feet but which was shut down in order to test the extent of the field.

Mr. Martin also announced that Union will drill a well across the border in Panama. Drilling will start late in September, he estimated.

New Mexico Oil Map

Mexican cartographers have completed a petroleum map of Mexico after 30 months of effort, according to Santiago Hernandez, engineer in charge of the project. The map, based upon aerial photographs, is on a scale of 1/2,000,000 and is printed in color. It outlines all known petroleum deposits as well as possible petroliferous zones. Manuel J. Alvarez, president of the Mexican Geological Society, describes it as "among the best in the world."

New Concessions in Colombia

The Colombian government has decided to enforce the law requiring firms holding concessions to sign contracts for them or yield them to the government in 90 days. The decision was made June 1st; August 31st was the first deadline.

To date (August 3rd) Intercontinent Oil Co. (a subsidiary of Standard Oil of N. J.) has signed eight (8) contracts for a total of approximately one million of the reported 25,000,000 acres which the firm still holds under concession agreements with the Ministry of Mines and Petroleum. How many more, if any, contracts Intercontinent signed before the August 31st deadline is not now known.

Shell, which had six options pending last June 1st, is still studying the matter. Texas Petroleum, the largest producing firm in Colombia, signed two contracts just prior to June 1st, and has not yet indicated whether it will hold onto or relinquish the remainder of its concessions.

Companies under contract are obligated to a higher fee for use of the land than when they hold it on a purely optional basis.

The government's decision to enforce the 90-day law is a direct result of the growing demand for petroleum products within the country and the increasing number of applications for concessions by new oil companies.

In the past few months exploration, drilling or recovery contracts with three companies now in Colombia for the first time—Cities Service, John W. Mecom and Forest Oil Co., have been signed. Land remaining under concession to older-established oil companies amounts to some 40,000,000 acres, or over five times the 7,500,000 acres actually under contract and exploitation.

Forest Contract in Colombia

A secondary recovery agreement between Forest Oil Corp., Bradford, Penna., and ECOPETROL of Colombia, provides 62.5% participation for ECOPETROL and 37.5% for Forest.

The new contract has not been made public officially. It provides an 18-month period of pilot flooding, in which any oil goes into a special account. There follow 30 years of operating, plus an option to Forest for 10 more years. During this period, any oil goes into a joint account.

Each party is to put up $4.5 million to pay costs. The split of oil by percentage is after costs have come out.

During the operating stage, a minimum of 200 acres is to be developed the first year, and a minimum of 350 each year thereafter. The contract is confined to the La Cira field, but it may be extended to Infanta field between the fourth and the sixth years.

Union Reiter-Foster Sign Cuban Agreement

Union Oil Co. of California, and the Reiter-Foster Oil Corp. of New York, have signed a letter of agreement covering operations of a 934,000-acre oil land mineral concession in Cuba. Under terms of the agreement, Union will assume operations of the joint holdings. Each company will hold a 50% interest in the property. The agreement calls for all geological surveys and exploration to be performed by Union Oil for a minimum of three years at no cost to Reiter-Foster. Tentative plans call for the drilling of two exploratory wells.

Grease Manufacturing Plant for South Africa

Shell Co. of South Africa has decided to build a complete grease manufacturing plant, and a lube oil blending and packing plant at Durban. The contract has been awarded to W. J. Fraser & Co., Ltd., Romford, Essex.

New Oil Terminal by Creole

Shown is an artist's conception of an artificial island off the La Salina Coast where Creole will construct a modern oil shipping terminal at a cost of 54 million bolivars ($162 million) for completion in 1957.

Approximately 4.5 million cubic meters of sand and sediment will be dredged during this operation which will continue until early in 1957. This sand and sediment will be used in the construction of the artificial island, which will be 2,900 feet long by 1,920 feet wide. The two concrete docks, which will each be 1,150 feet long by 790 feet wide, will be of modern design, their steel and wood fenders protected by rubber buffers, until now used only on small docks.

The terminal, which will consist of six storage tanks, 4 of steel of 286,000-barrel capacity each and two of concrete and clay of a million-barrel capacity each, has been planned with the company's future operations in mind, so that it may be enlarged to double its capacity if necessary. Supertankers of up to 60,000 tons will be able to moor at the dock. The project will be completed in the latter part of 1957.

Bolivian Oil Area to be Developed

During the visit to Brazil of the Bolivian president-elect at the end of July, the two governments decided to appoint a commission, to meet in October, and discuss means to give effect to the clause of the 1938 Treaty, regarding exploitation of Bolivian oil.

A protocol to the 1938 Treaty provided for the organization of mixed Brazil-Bolivian companies to exploit, with a 55-year monopoly, the oil reserves in an area of 116 square miles between the rivers Ichilo and Parapeti. The Bolivian president-elect suggested that Brazil should renounce her rights, or offer real guarantees that she will comply with the terms of the treaty within a reasonable period.

Shale Oil Ruling in Brazil

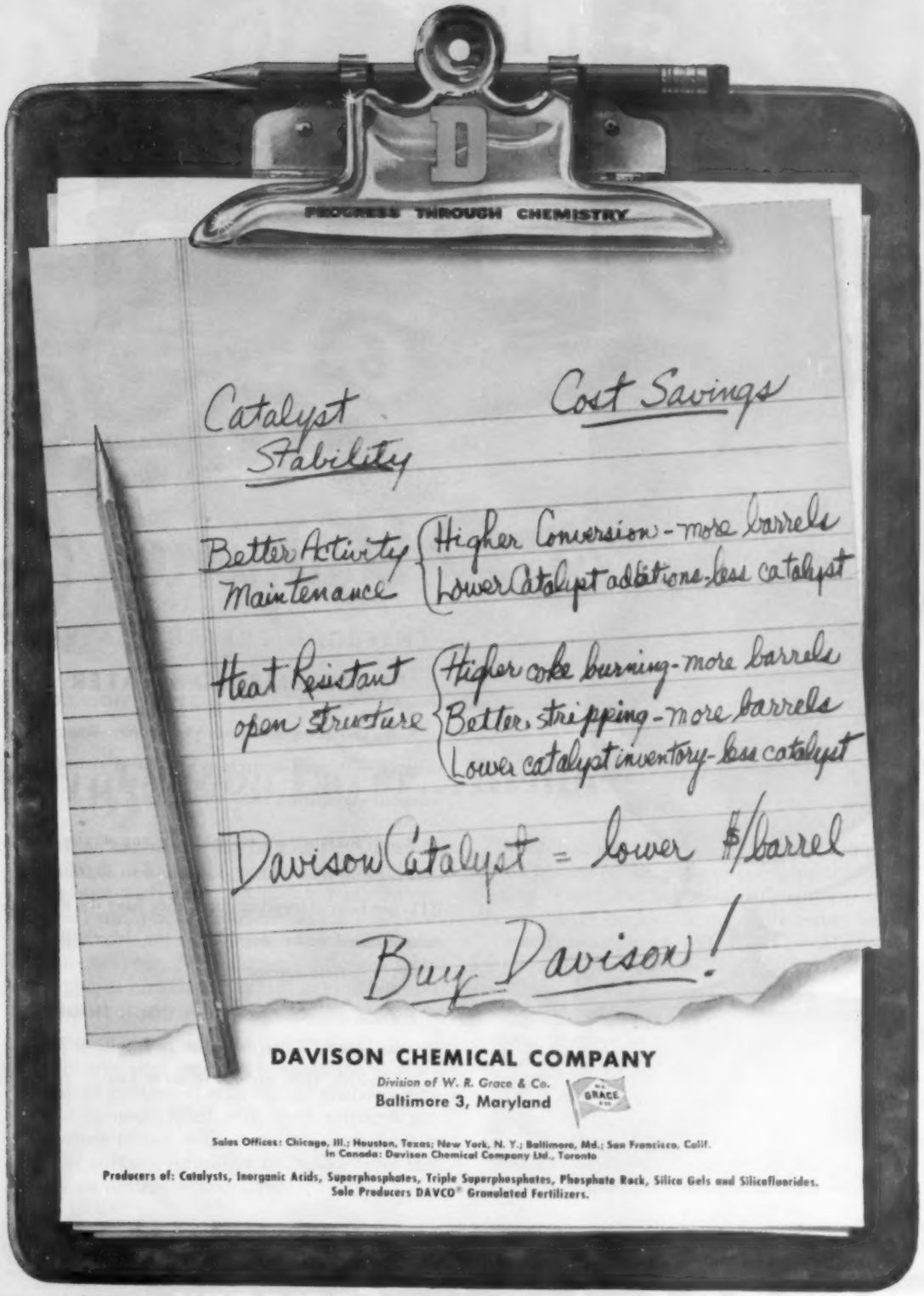
Replying to a consultation by the president of Petrobras, advising that companies were being organized to exploit bituminous shales industrially, the Petroleum Council of Brazil decided unanimously recently that "prospecting, mining and industrial exploitation of bituminous rocks, including extraction of crude oil, are not included in the state monopoly, but that the monopoly includes the refining of the oil derived therefrom."

Brazilian Exploration Rising

Preliminary tests on offshore well DJI36 (D. Joao field), 4.8 miles from the beach, indicate a probable production of 200 bbls. per 8-hour day.

Wildcats, now drilling, had reached the following depths, in feet, early in July: AMAZON—Abacaxis (RXI-AZ), 7,182; Nova Olinda (NO2 and NO3 AZ), 5,788 and 2,824; River Cupari-Tapajos (CPSTI-AZ), 1,160. MARANHAM—Testa Branca (TBI-MA), 5,037; Mocambo (MOI-MA), 8,330. RIO GRANDE DO NORTE—Macau (MCI-RN), 637. BAHIA—Jacuipe (JI-BA), 7,885. PARANA—Candido de Abreu (CAI-PR), 2,590. Fourteen other wells are being drilled in Bahia to extend existing fields. The productive area is proving much more extensive than hitherto believed.

Col. Nunes, Petrobras' head, says 27 geological teams and 27 rigs are now operating and the numbers will be raised to 32 and 41, respectively, by December next. Petrobras has signed a contract with Seismograph Service Corp. for geophysical investigations in new areas.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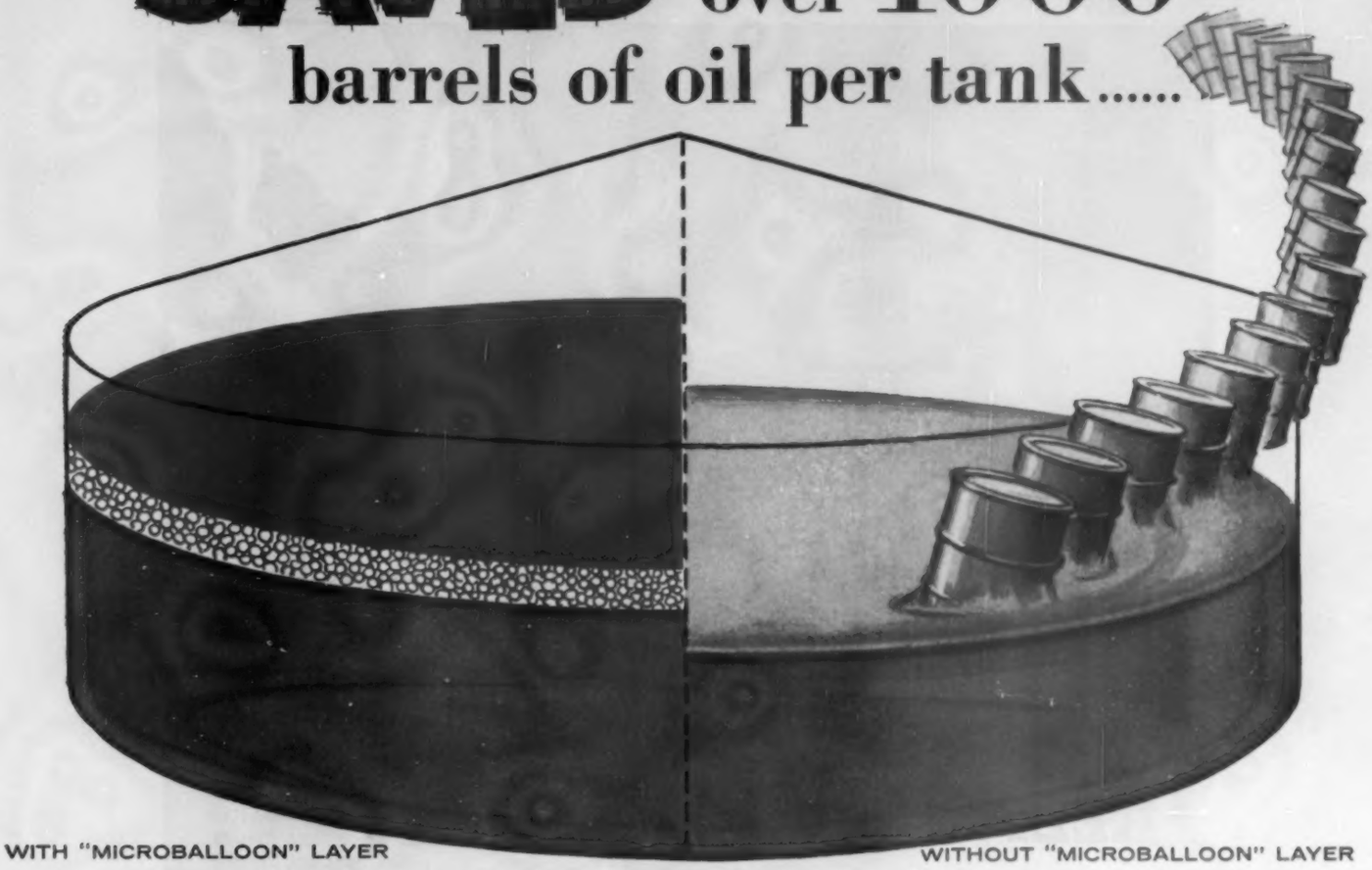

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The floating blanket of "Microballoon" spheres that controls evaporation is made up of millions of microscopic phenolic plastic spheres, filled with inert nitrogen gas. When mixed with crude oil, they float to the surface, forming a foam-like layer that seals against evaporation.

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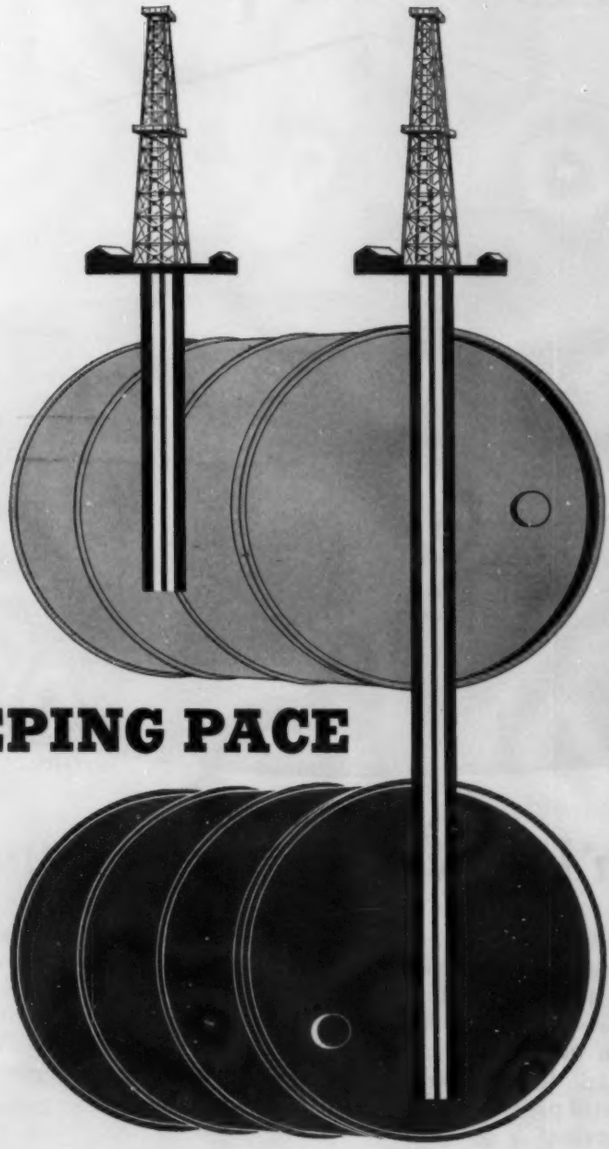

KEEPING PACE

Drills were chewing their way down for about 2000 feet in the search for oil in 1916. Today's drilling depth is more than double that.

The change in drilling that forty years has brought well symbolizes many advances in the petroleum and chemical industries. Engineers have dug more deeply into the secrets of nature, too . . . have designed plants and processes to wrest new products and services from petroleum, ores and elements.

We mentioned 1916 because that is the year Sun Ship was founded. It has long served the swift-growing needs of petroleum and chemical industries. Year by year, the engineering skill and facilities of the great Sun Ship plant have proven their ability to meet the demands for plant and equipment keyed to the swift pace of progress in these and other important fields. Sun Ship keeps pace with progress.

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SINCE 1916

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INDONESIA comprises the largest group of islands in the world, stretching out along the equator for more than three thousand miles . . . Java, home of the nation's capital, Djakarta, with 54 million of Indonesia's 80 million citizens, is about the same size as New York State. Sumatera, Kalimantan (Borneo), Bali, Sulawesi (Celebes)—these and other exotic islands of the group have a combined land area of about 735,000 square miles. Indonesia's modern economic history goes back to the 15th and 16th centuries, when Portuguese and Dutch traders began developing the spice trade and the "fabulous wealth of the Indies." An independent, democratic republic since August 17, 1945—and the world's third richest country in known natural resources—Indonesia is today spending millions of dollars to modernize and expand its industry, agriculture, and transportation, at the same time increasing its world exports of rubber, petroleum products, tin ore, copra, tea, tobacco, palm oil, coffee, pepper, and sugar.

Standard-Vacuum's part in the development of Indonesia's petroleum industry covers a wide range of operations from geophysical exploration and production through transportation, refining, and marketing of petroleum products. Ninety-six per cent of Stanvac's 14,000 employees in this area are Indonesian nationals.

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A name that stands for "Progress" in the East

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SOUTH PACIFIC ISLANDS • SOUTH WEST AFRICA • TANGANYIKA • THAILAND • UNION OF SOUTH AFRICA • VIETNAM

Gulf Sales Engineer Thomas H. Chambers, Beaumont, Texas District (left) and R. W. Haney, Chief Engineer of the United Gas Pipe Line Company's Goodrich, Texas Compressor Station, inspect the company's six Ingersoll Rand 1320 H.P. K.V.G. engines. All these engines are lubricated with Gulf Security.

Lock out high maintenance costs in your gas transmission plants

with GULF SECURITY

Gulf Security's outstanding record in the lubrication of pipeline gas engine compressor units is your assurance of smooth, continuous operation. In scores of gas transmission plants this high quality straight mineral oil helps prevent operating troubles and contributes to low maintenance costs.

Gulf Security is a non-additive oil that does not cloud liquid filled lubricators of power cylinders, compressor cylinders, and packing glands. After years of operation with Gulf Security, cylinders and piston rings of both compressors and power assemblies show negligible wear, and its excellent oxidation stability helps prevent the formation of acid and resins in the crankcase system.

Make certain your units receive safe, effective lubrication protection—specify Gulf Security. And remember that Gulf provides the services of a trained, experienced petroleum expert—the Gulf Sales Engineer—to help you with any problem involving a petroleum product. Consult the telephone directory for the number of your nearest Gulf office.

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BONUS-POWERED! All new International Crawler Tractors have heavy-duty engines to handle the biggest jobs... with more than enough "bonus-power" to make bid time plus extra profits for you.

NEW FEATURES! All new International Crawlers have these special advantages: push-button gasoline-conversion starting; full-flow lube oil filters and pressurized cooling; increased capacity transmissions and straight-line power train.

NEW RUGGED CONSTRUCTION! All new International models are equipped with long-life power-grip cerametallic clutch facings, improved positive track-roller seals, reserve track-frame strength and live-action traction weight.

New TD-18 and TD-14 have heavy-duty "swinging door" radiator guard for mounting direct-lift equipment. New vertical louvered grill on TD-9 and TD-6.

See your IH dealer for a powerful demonstration or write for catalog. Complete line of new IH matched hydraulic or cable graders and dozers available for every new International crawler model.

TD-6 41.5 drawbar hp. 8,890 lbs.

TD-9 54.5 drawbar hp. 12,000 lbs.

TD-14 78.5 drawbar hp. 21,095 lbs.

TD-18 103 drawbar hp. 29,050 lbs.

TD-24 161 drawbar hp. 42,780 lbs.
200 engine hp. (torque conv.) 43,080 lbs.

Operating weights shown less equipment.

NEW "CONTROL-TOWER" VISIBILITY! All models have full job-control view, one-glance instrument panel, wide foam rubber seat, big arm rests and flush air-cooled deck. Exclusive IH Planet-Power steering on TD-24, hydraulic steering on the 18 and 14, spring booster steering on the 9 and 6. Driver does more work, easier, faster.

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DU PONT

PETROLEUM CHEMICALS DIVISION

NEWS

DU PONT

October ★ One of a Series of Bulletins for the Petroleum Industry ★ 1956

Merchandising Opportunities in Improved Oils

With the "super premium" gasolines so much in the news, there's an especially good marketing opportunity for premium motor oils.

Consider, for example, an oil with low-duty detergency for stop-and-go driving. The majority of American passenger-car driving consists of trips shorter than 10 miles. And more than 90% of all city bus, taxi and delivery truck operation is in stop-and-go city traffic. These low-power, low-temperature operating conditions, of course, are likely to result in excessive build-ups of engine sludge. This means that there is a considerable market for a new type of lube oil with low-duty detergency.

New polymeric additives

To give oil this property, Du Pont has developed two synthetic detergents... Lube Oil Additives 564 and 565. Both are ashless polymeric additives, slightly basic, that provide an economical and effective means of preventing engine oil sludge – particularly under low-duty, stop-and-go driving conditions. And these additives are effective V.I. improvers as well as detergents.

Any of our sales offices will gladly supply additional information, and a suggested promotion kit.

Additives prevent many oil-burner troubles

With the heating season just getting under way, many old familiar oil-furnace problems will be back to cut, unnecessarily, into fuel distributors' profits through another season.

Plugged nozzles, screens and filters; gel-clogged lines; ignition and stack control failures may all have been part of a day's work for distributors and servicemen last year. But this year can tell a different story. Here it is . . .

When heating-oil is sold on a service-contract basis, every service call costs the supplier money, obviously. This of course comes out of profits. Fortunately, however, many of these common headaches can be prevented with minute quantities of low-cost Du Pont additives.

To prevent sludge . . .

Du Pont Fuel Oil Additive No. 2 (FOA-2) is a double-action additive that works effectively both as a dispersant and as a stabilizer.

It minimizes the formation of insoluble residues. It also helps to rid dirty systems of sludge deposits previously accumulated, by reducing the size of the sludge particles so finely that they do not clog screens or nozzles. In this way, it can actually help reduce the man hours required for distributors' service calls.

Why many railroads prefer economy fuels stabilized with Du Pont FOA-2

Fuel specialists and purchasing agents of many railroads are taking a keen interest in the use of Du Pont Fuel Oil Additive No. 2 (FOA-2) for stabilizing all their economy grade diesel fuels.

Uniform results in a variety of different fuel stocks are a big reason.

Since diesel fuels—especially economy grades – vary widely in their response to additive treatment, you can readily see why such uniformity is an important advantage to the railroads which often have a number of different suppliers loading into the same tank.

After carefully testing economy fuels with a number of different additives for several years, it has been found that FOA-2 gives good results over the widest range of varying fuel stocks. Because of its outstanding stabilizing and dispersant action, FOA-2 helps to cut maintenance costs by relieving filter-plugging and injector-sticking problems. Moreover, the additive does not contribute to the sparking problem which may accompany the use of economy diesel fuels.

If you would like more detailed information about on-the-railroad results obtained with FOA-2, just get in touch with one of our representatives.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION NEWS

CONTINUED *Heating Troubles*

To keep electrodes and stack controls clean . . .

As distributors well know, a number of burner failures are due to insulating deposits on the stack controls and ignition electrodes. Because FOA-2 is a nonmetallic, *ashless* additive, it leaves no deposit to insulate electrodes . . . or to interfere with the operation of control mechanisms.

Du Pont FOA-2 helps prevent nozzle plugging

To prevent gel-clogged lines

Du Pont Metal Deactivator (DMD) can be used effectively to prevent *copper* fuel lines and filter screens from playing mischief with the chemical composition of heating oils. When unchecked, the copper is likely to cause the formation of a gelatinous substance . . . and complete stoppage of fuel flow.

DMD can be economically used in combination with FOA-2. When the two additives are combined, the DMD frequently carries part of the stabilizing load—thus reducing the amount of FOA-2 that is needed for sludge prevention.

For best results

FOA-2 and DMD should be added to freshly prepared stocks at the refinery. For more detailed information on the use and performance of these additives, just get in touch with one of our representatives at any of the sales offices listed below.

ASSISTANT DIRECTOR IN CHARGE OF PRODUCT EVALUATION

Dr. Robert H. Blaker joined the Du Pont Petroleum Laboratory in 1953 as research supervisor, became head of the Combustion Division in 1954 and was appointed assistant director in charge of product evaluation in February of 1956.

Dr. Blaker joined Du Pont in 1950 as research chemist at Jackson Laboratory, where he also served in the Petroleum Division, after an initial assignment in synthetic fiber dyeing.

Berea College awarded Dr. Blaker an A.B. degree in chemistry in 1942. He also attended M.I.T. and received his Ph.D. in physical chemistry at California Institute of Technology in 1949. Dr. Blaker also studied in Britain under an Imperial Chemical Industries grant.

He is a member of the Society of Automotive Engineers and the Petroleum Division of the American Chemical Society.

DR. ROBERT H. BLAKER

New findings on fuel performance in high-compression engines

How much will compression-ratio increases boost octane requirements?

Not necessarily as much as has been generally thought—according to the results of recent studies at the Du Pont Petroleum Laboratory.

Our tests showed that the engine-design, fuel and lubricant, *all* have a significant bearing on engine-performance. This indicates that octane requirements of high-compression engines can be kept at a minimum by careful attention to *each* of these three factors.

A surprising development was noted in one car operated at an 11:1 C.R. Running under normal conditions, this car was found to be free of combustion noise, even on a 100 octane fuel.

It was found that the 90% distilled point is not necessarily the criterion for measuring deposit-harm of fuels. This can mean that there will be more latitude in blending the components for high-compression fuels; more heavy ends may be used in this type of fuel, without detrimental effects on the engines.

The tests also indicate that octane requirements of high-compression engines can be reduced by improvements in lubricants and through engine design.

A paper with full details on this testing program was recently presented at the API Refining Meeting in Montreal. Just drop us a line if you would like a copy.

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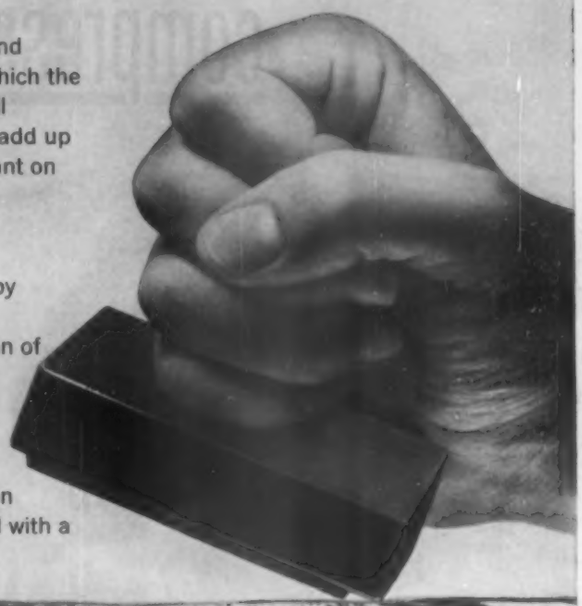
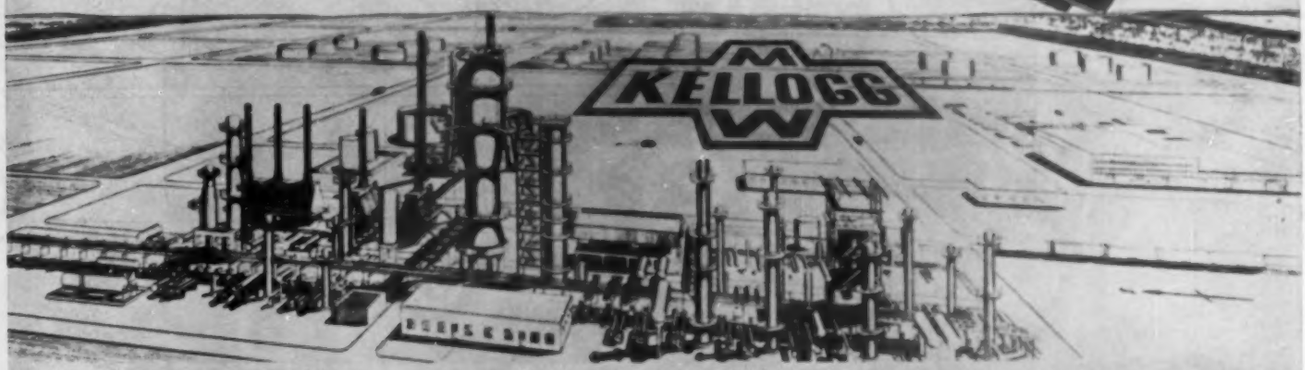
Soundest Way to Erect and Protect a Multi-Million Dollar Investment

The ultimate cost of a 10-, 20-, or 30-million dollar petroleum refinery is determined not by the figure on the engineering and construction contract, but by the speed and efficiency with which the refinery can be put on stream. Lost production can cost an oil company thousands of dollars daily and, for large refineries, add up to millions. Sound protection against delays in putting the plant on stream or against failure to fulfill production guarantees promptly is to assign all or a major share of engineering and construction to The M. W. Kellogg Company.

The bigger the investment, the more a refiner can benefit by enlisting the long and broad experience of this world-wide organization. A contract with M. W. Kellogg expedites selection of the most economic processes . . . integrates plant design for maximum output of individual units . . . assures the proper materials to minimize corrosion . . . means the utmost in efficiency of piping, instrumentation, every phase of the job.

Whatever the assignment or its size, refiners can depend on M. W. Kellogg to get their investment on stream quickly—and with a firm guarantee of product yield and utility efficiency.





American Oil Company's 35,000 BPD refinery at Yorktown, Virginia — now under construction. The M. W. Kellogg Company was given the engineering and construction responsibility for all offsite facilities and a number of the major process units for this $30 million refinery. These units include those for atmospheric distillation, vacuum distillation, fluid catalytic cracking, catalytic polymerization, gas recovery, and gasoline and kerosene treating — all piped together to form one integrated processing operation.

REFINERY PROCESS DIVISION

THE M. W. KELLOGG COMPANY

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compressor designs also become

New automobile designs with startling advances in styling and performance present their appearance every year. Engines considered to be the last word a few short years ago, have been scrapped in favor of new models possessing greater performance and stamina.

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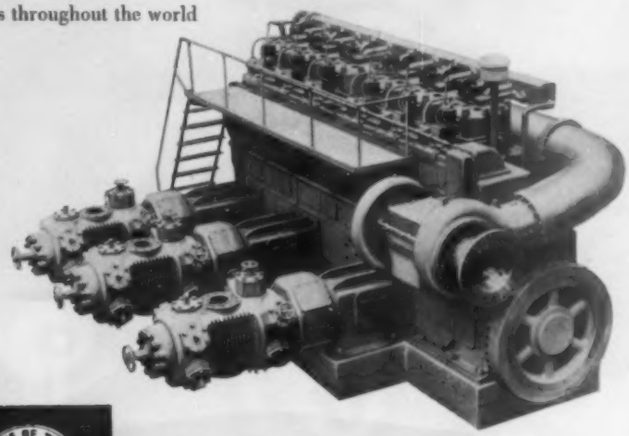

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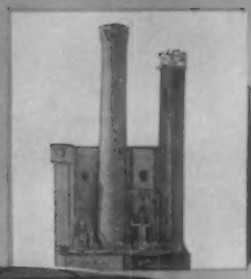

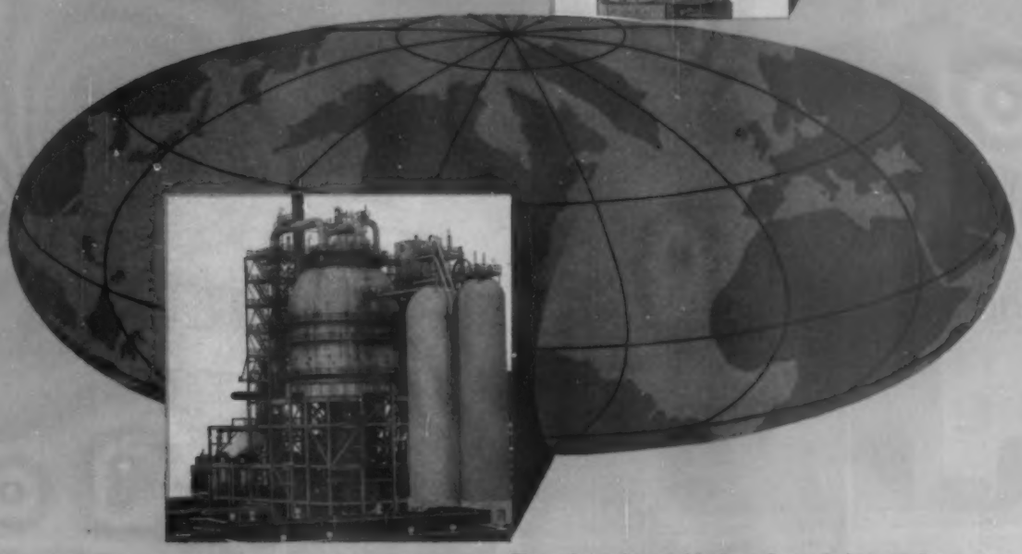

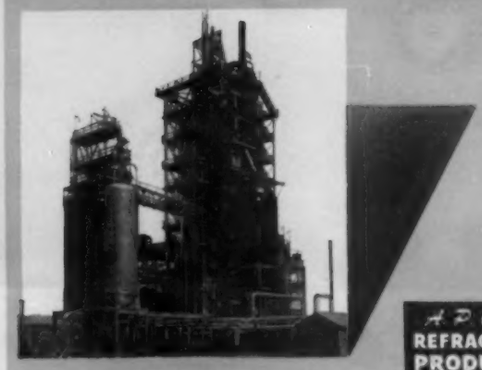

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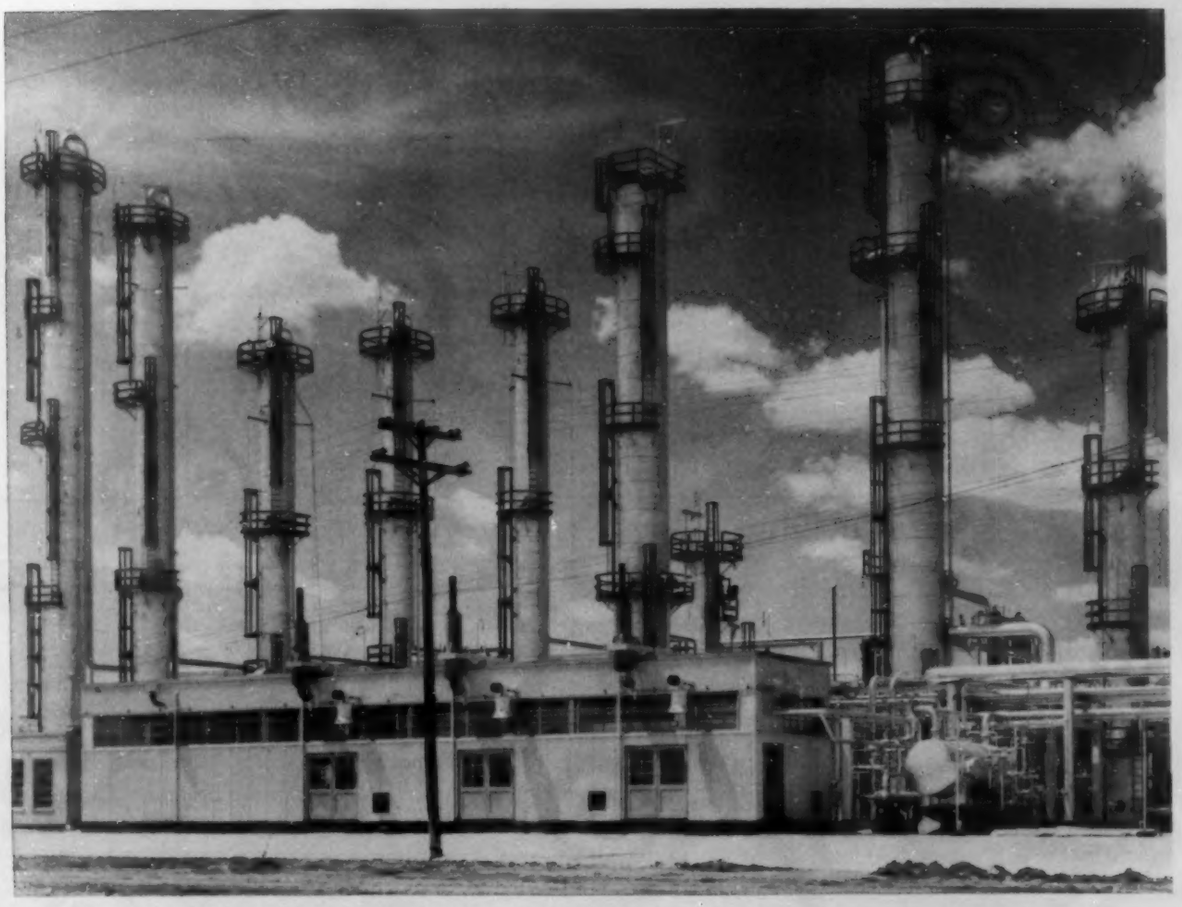
PROCON BUILDS UOP REXFORMING UNIT FOR COSDEN IN RECORD TIME

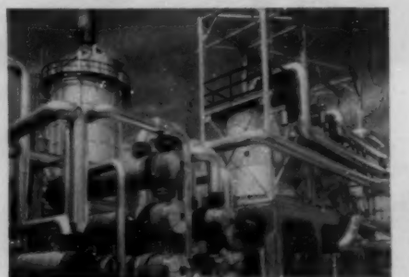
Another important oil refinery construction achievement for Procon



New Rexforming unit at Cosden just after going on stream

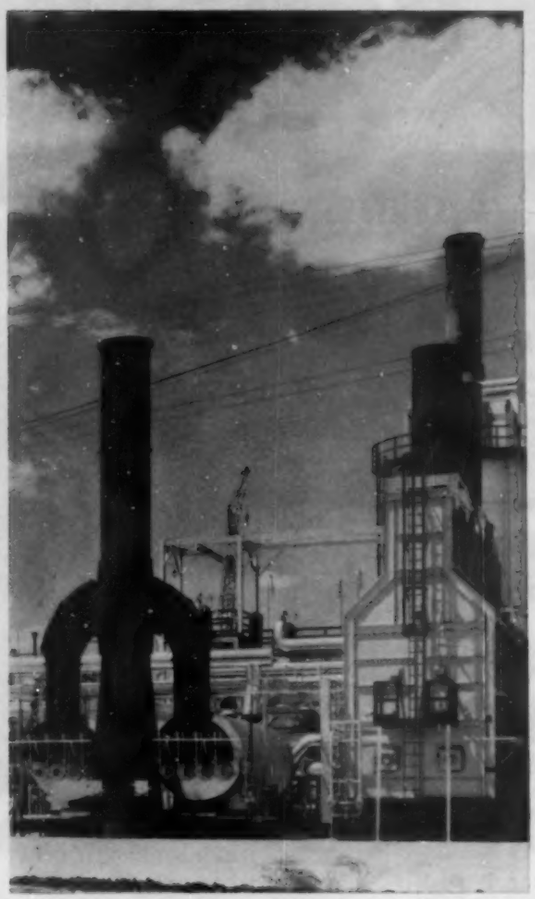
Ray Tollett, President (center) and Dan Krausse, Manager of Production (left) of Cosden congratulate Martin McReynolds, Field Construction Superintendent for Procon

This control room directs the operation of the Rexforming unit



The heart of the Rexforming unit, the Reactors

Some months ago, Cosden Petroleum Corporation, Big Spring, Texas, gave Procon the responsibility of building their new Rexforming refining unit. Cosden's requirements for the construction specified completion "at the earliest possible time". Procon finished this project, the first Rexforming unit anywhere in the world to be built wholly from the ground up, in approximately six months. It is an outstanding example of Procon's ability to meet the most exacting construction requirements on time and right up to every specification.



Site 30 days after ground breaking

Ground was broken for the new Rexforming unit on January 18, 1956 and completion was promised in approximately six months. In order to meet this time requirement, Procon engineers realized it was necessary to break away from routine methods and use every time-saving method possible consistent with good construction practice. Accordingly, it was decided to proceed as far as possible with the basic construction even before the major columns could be finished and placed in position. This presented a delicate problem since, as the columns were completed and delivered, it was necessary to move them into position with the rest of the construction being ahead of the usual status for their easy installation. This was handled without flaw by the Procon construction crew on the job and the new unit went on stream just 190 days after ground had been broken.

Column just fits in space between partly completed construction

Column is carefully maneuvered into place

One of the principal problems was the positioning of the extractor column, RXV10, the largest in the unit. It had to be fitted carefully into the half-completed construction and maneuvering it into position in a space that permitted only a few inches leeway was an unusually competent construction accomplishment.

Procon offers a complete engineering service for the oil refining, petrochemical and chemical industries. When you give the job to Procon, you can be sure of completion on time and up to every specification.

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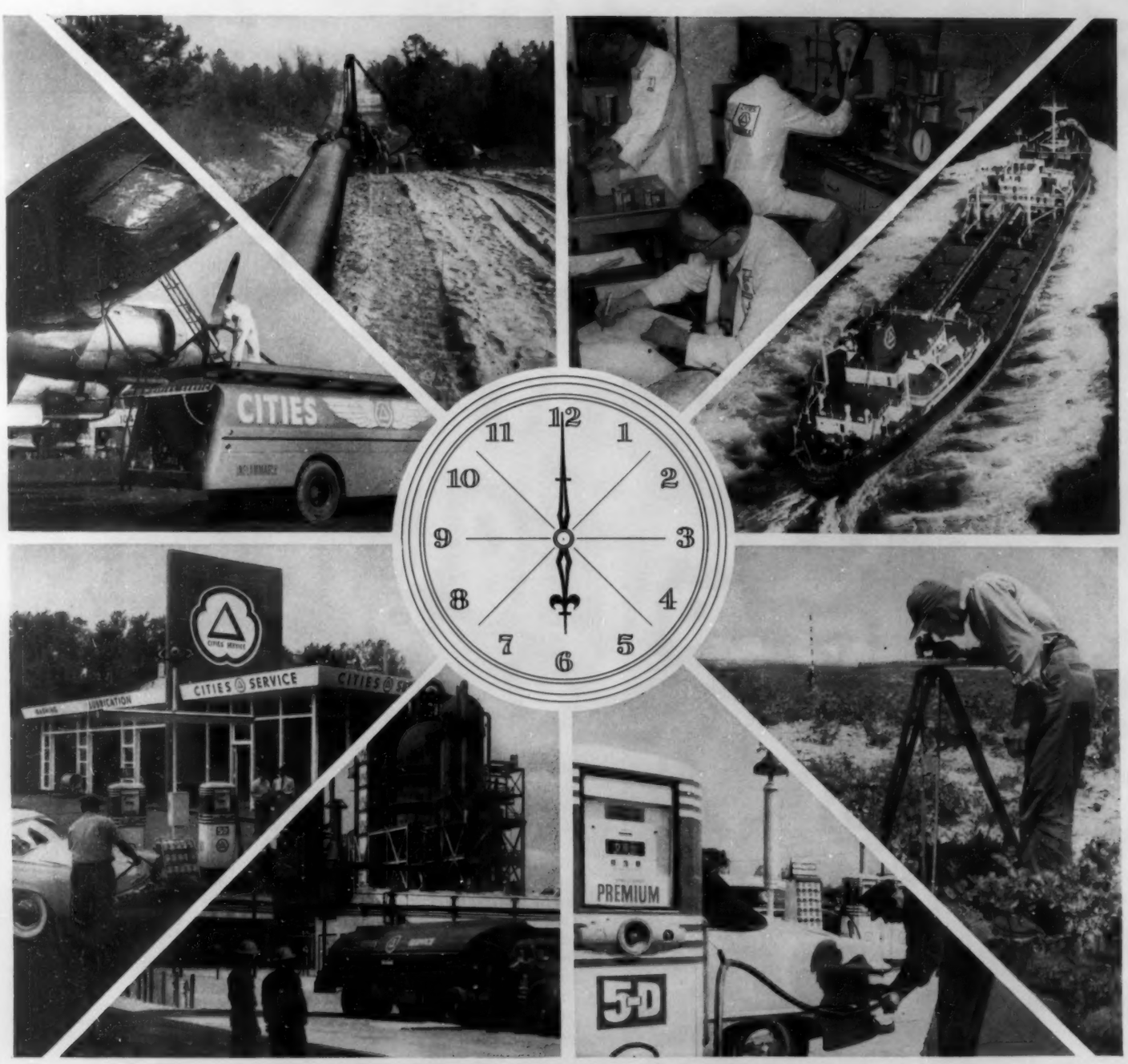

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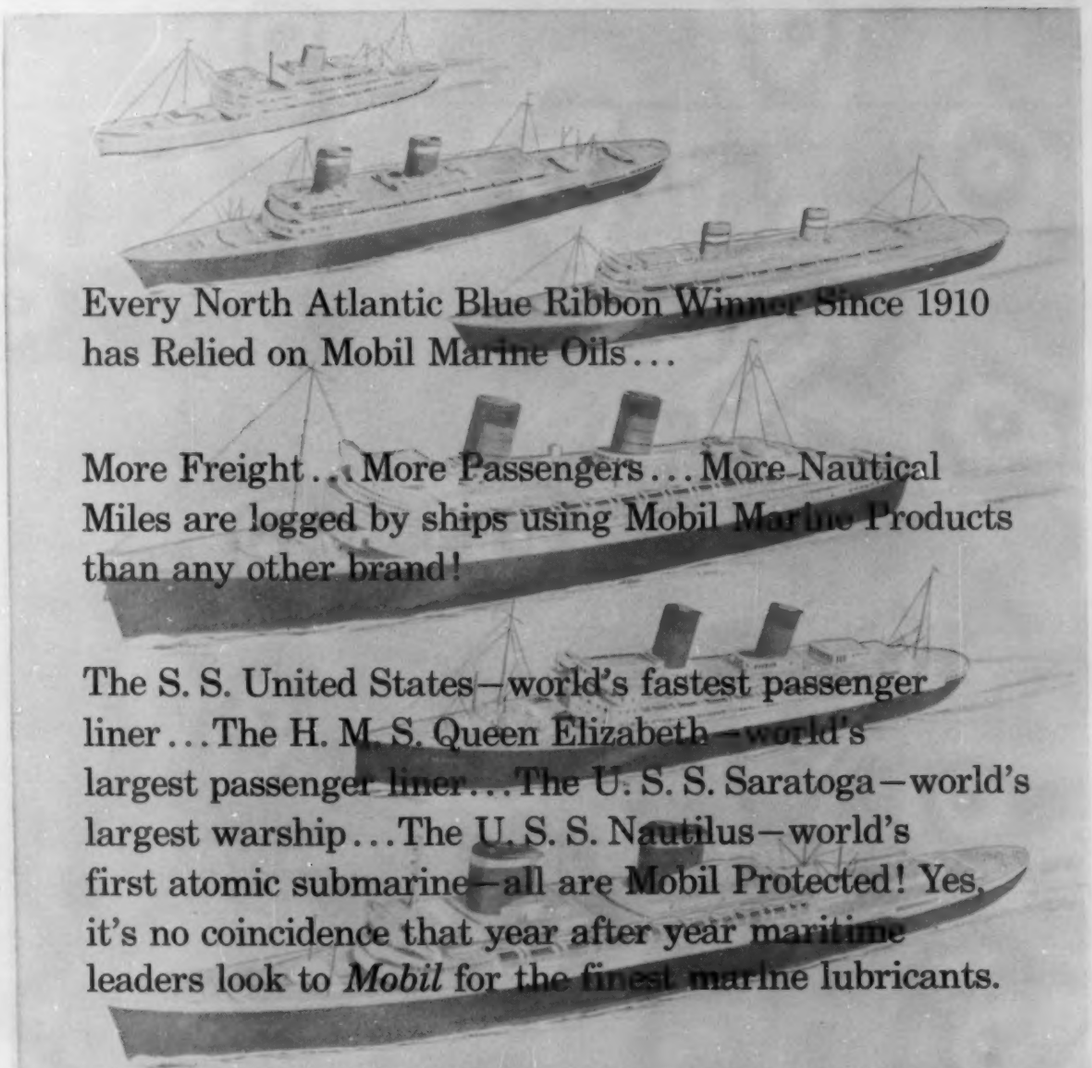

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Lummus, Aramco teamwork supplies more quality gasoline from Saudi Arabia

In August at Ras Tanura, Saudi Arabia, a 12,500 B/D Fluid Hydroformer is undergoing its first turnaround since it came on stream in October, 1955. For the past 10 months this unit has supplied 92.5 F-1 clear octane blending stock to European and Middle East markets, where the need for quality gasoline is growing rapidly.

The Hydroformer was designed and engineered by Lummus for The Arabian American Oil Company under license from Esso Research and Engineering Co. The process, though more complex than any other in the Ras Tanura Refinery, was designed for ease of operation to fit in with the Company's policy of training and upgrading Saudi Arab nationals to the fullest extent.

Close liaison among the three groups during all phases of design and construction has paid off. Startup was smooth, with all facilities operating at full design rate soon after feed was introduced. And the plant has been operating successfully ever since, at and above the design rate. In all cases, hydroformates of premium quality have been obtained from the high paraffin – low naphthene stocks characteristic of Arabian crudes.

Test runs at feed rates of 12,500 – 16,300 B/D have yielded products of 94.8 – 87.4 F-1 clear octane. There has been no difficulty in making the 92.5 octane design product at rates up to about 13,500 B/D. These tests indicate that hydroformates close to 95 F-1 clear can be produced in good yields, and should higher quality be needed, more severe hydroforming conditions appear to be feasible.

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ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

VOL. 27, NO. 11 OCTOBER, 1956

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THIS MONTH'S COVER

Drilling offshore is on the upswing. Shown are roughnecks on the platform of an offshore drilling unit in the Gulf Coast area, lifting tools with a boom on a converted LST.

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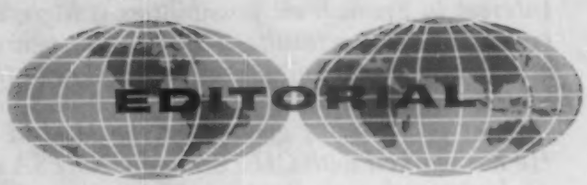


Specialization in the Refining Industry

WITH the approach of the final quarter of each year, the management of integrated refining companies give thought to the portion of their facilities which they should devote to products especially in demand during the winter months in northern latitudes. Little guidance is afforded by the precedent of past years because of wide variations during recent years in temperatures and transport conditions, both in the United States and Western Europe.

Latest estimates of the Bureau of Mines of the United States, based on figures released during the first week of September, pointed to 9,200,000 b/d and new supply from all sources to 9,300,000 b/d for the year. Contrary to usual expectations at the end of the summer season, stocks of gasoline were higher than a year earlier, while stocks of distillate were lower. Supplies of heavy residual fuel oil were slightly below the corresponding date of the year preceding but were showing a tendency to rise.

Judging from past experience which, as already stated, is not to be accepted as at all certain to hold good in the case of distillate fuel, a larger stock of this type of fuel oil should be accumulated along the Gulf Coast. Possible suspension of traffic through the Suez Canal might interfere with additional supplies from this source, but in such cases surplus stocks of crude and manufactured products of all kinds will be drawn upon from American sources.

With the extension of natural gas pipe lines, district and national, across the United States, it is stated by the American Gas Association that gas holds first place in fueling centrally heated homes in the United States, now serving 10.2 million homes with heat compared with 10.1 million using oil and 7.5 million depending on coal. Although preference was shown for natural gas where it is cheaply available, nearly 300,000 oil-heating units were installed in areas where gas connections were not obtainable, this being a reduction of about 20 percent from the proportion of the year preceding.

A tendency observable throughout the oil industry is to develop processes for the treatment of lower grade crudes to manufacture special products. A special feature of factory installations of diesel oil during the first half of 1956, as compared with the corresponding period of 1955, was the drop of nearly 50 percent, while commercial industrial oil burners more than doubled during this period.

The progress of specialization which has been characteristic of the refining branch of the petroleum industry has received a special impetus which increasing attention and research has provided. As a result, some of the smaller refineries have been able to increase the octane value of their output without undertaking the heavy investment demanded by the huge installations of the past few years.

The advantages of diesel oil for railway operation have led to the general dieselization of railways by use of straight run distillates, but with the rise in cost of these fuels recourse is being had to fuel injection and use of the gas turbine for further economies.

Typical of the conservative attitude of the oil refining industry toward related fields has been its position toward the chemical industry. While the advantages of refinery gases for utilization in many chemicals has been well understood for years, the oil industry with few exceptions was satisfied to let the early advances toward cooperation come from chemical manufacturers, retaining for their own part provision of the basic materials. As the affinity of the two industries became better understood, however, leading oil companies have found it worthwhile to establish chemical subsidiaries or branches of their own.

A quarter of a century ago, one of the close students of oil and a leader of the petroleum industry undertook a campaign to urge that petroleum be restricted to what he defined as its "superior uses," of which he insisted that hundreds would be found. Actually, thousands rather than hundreds of important uses have been found in the century of the industry's commercial existence without as yet restricting its employment to superior uses.

Concentration of research on the development of special products and the utilization of less expensive methods has enabled petroleum to keep well in advance of competitive forms of energy production. Thus, while natural gas impinges on certain diesel uses and nuclear energy looms as a possible substitute for heavy power concentrations, it has been found possible to make use of former wastes and low-cost elements such as jet fuel to execute tasks that formerly called for highest grade fuel.

Interest in Spanish oil possibilities is high, stimulated by encouraging drilling results in the past few years. The recent Suez crisis has put a premium on production in this strategic area, which the author is in a unique position to evaluate. He is at present professor of geology at the Madrid School of Mines. He has worked with CIEPSA and CAMPSA since 1939 as field geologist and consultant, and is now serving ADARO in the same capacity.

The Search for Oil in SPAIN

By Jose Maria Rios

A GLANCE at the map of the Mediterranean, a sea rimmed with folded alpine ranges, shows that many of the countries surrounding it are producers of petroleum.

Some are large producers, like Rumania and the countries of the Middle East; though not all of the latter are strictly Mediterranean, they belong to the same geological province as the bordering mountain chains.

Others such as France, Italy, Algeria, Tunis and Morocco have made a recent appearance among production statistics, but with steadily increasing figures. Yet Spain, related to these countries by geological history and structure, and forming the geographical and geological link between them, shows no production at the present time.

There is nothing, either in Spanish geological history or subsoil, either in themselves or as compared with those of neighboring oil-producing countries, ruling out hydrocarbon deposits. In fact, such presence is positively indicated both by oil seeps and oil and gas shows in exploratory wells.

Some regions are certainly sterile; hydrocarbon deposits are unlikely in others, and difficult to search out systematically in still others. There remain, however, some that strongly invite investigation. In these, far too little has been done for their adequate exploration. That is to say, incomparably less has been done than in neighboring countries of comparable geological constitution by the time oil or gas were found, and much less than is usual in most countries where they have been found.

From these generalizations, we may draw the conclusion that there is no occasion for pessimism concerning future production of hydrocarbons in Spain.

Prospecting and Exploratory Activity. Petroleum prospecting in Spain goes back to 1860 when the first claims were filed and staked for petroleum. The first important well drilled was that of Huidobro in 1900.

The first stage of exploration up to World War I was utterly unorganized. Neither financing, nor machinery, nor methods were in most instances equal to the task.

A shortage of oil in 1914-1918 induced the State to intervene directly, through its Instituto Geológico (Geological Survey of Spain). The price rise of 1921 revived private interest, and foreign capital and engineers came in, especially British. In 1927, petroleum refining and distribution in Spanish territory (except the Canary Islands) was made a monopoly of a company (CAMPSA) bound by contract to carry on prospecting operations.

Soon after, in 1929, a private company was organized (CEPSA) which acquired concessions in Venezuela, set up a refinery in the Canary Islands, and engaged in importation and transport, establishing a tanker fleet. This company has since greatly expanded its scope and scale of activities.

Both companies, CAMPSA and CEPSA, had begun or were organizing their prospecting surveys in 1936, when the Civil War broke out, compelling them to suspend operations.

All together, from 1900 to 1940 only 15 important wells were drilled, and only four of them to beyond 3,000 feet. They were sunk by various private companies, by CAMPSA and by the Geological Institute. Two of them have quite recently been reopened. None achieved any industrial production, but only four were completely negative; six showed minor positive indications, and the rest intercepted strata of definite promise. At Gastiain, rig engines operated for a time on gas furnished by the well. The Bornos-Villamartín well, which yielded short-lived production of very fluid and transparent crude, amber in color and highly aromatic, has also recently been renewed. The Huidobro and Leva wells also had shows.

Geophysical surveys have been conducted in various petroliferous regions, in preparation for some of the drillings mentioned above, and elsewhere. Seismic reflection techniques were not introduced until much later, in 1952.

When the Civil War opened, the State was drilling two wells under the management of the Geological Institute. They were closely adjacent, in the Eastern Pyrenees (region 1b). Owing to events of the war, progress was very slow, and one was abandoned. The other (Suterraña, Tremp) reached a depth of 1,700 meters, striking slight indications at that point. It began at the top of the Upper Cretaceous. In 1939, it was the deepest well to have been drilled to that date.

Recent Exploration: Exploration on a modern basis began in 1939. Both CAMPSA AND CEPSA then reorganized their programs of investigation. The latter company, in 1940, formed a subsidiary known as CIEPSA in cooperation with Socony Vac-

Exploratory Drilling by CAMPSA[1]

Well	*Total Depth (Meters)*	*Results*	*Remarks*
Tudanca	445	Dry	Encountered fault.
Zamas I	602	Oil & gas shows	All in Albian-Wealden.
Zamas II	820	Many oil shows	Shows in Lias 655-677 meters.
Zamas III	860	Oil and gas shows	Bottomed in Lias, shows various levels.
Pena Ortun	1,264	Oil and gas shows	Bottomed in Lias, shows in Jurassic & Lias.
Dobro	1,221	Dry	Bottomed in Wealden.
Vollanuevea de Rampalay	2,177	Many oil & gas shows	Bottomed in Wealden, shows in Lias.
Delica	588	Dry	No fozzilization. Ended in Cenomanian.

[1]For well locations, see Figure 4.

uum Oil Española. Both organizations set up teams of geologists the former of Spanish nationality, the latter Spanish and U.S., who waged extensive prospecting campaigns. A series of mineral concessions, as outlined in Fig 3, were applied for.

In 1942, the Empresa Nacional ADARO was formed as a prospecting agency of the government's National Industrial Institute (INI), and entered oil exploration in 1944.

In 1952, the Comisión de Investigaciones Petrolíferas VALDEBRO was formed by agreement between INI and the General American Oil Co. of Dallas, Texas. VALDEBRO was initially licensed to explore the upper part of the Ebro Valley, which territory was later extended to the valley as a whole. Late in 1952 all national territory was reserved to the government, not withstanding prior prospecting licenses or claims staked, and INI was assigned to develop a program of exploration. Management of VALDEBRO is in the hands of the director of ADARO. ADARO's staff cooperates with the American engineers of De Golyer & MacNaughton, a shareholder in VALDEBRO and consultant to the General American Oil Co.

CIEPSA terminated its association with Socony Vacuum Oil Española in 1950, in consequence of the latter company's reducing foreign activities, and in 1953 entered upon collaboration with the firm of C. Deilmann Bergbau, Bantheim.

CAMPSA holds 13 exploration licenses covering a total of about 197,600 acres. Its equipment is limited to a small rig, with which it drilled wells 1, 2 and 3, another somewhat larger rig for well 4, and an American rotary rig supplied by Oilwell of 6,500-8,000 feet capacity. Technical assistance and personnel are contracted from FOREX of Paris, working together with the Spanish staff. No geophysical surveys have been made by CAMPSA.

Although geological reconnaissance operations have extended over many areas of Spain, exploratory drilling by CAMPSA has been restricted to one very promising zone (Figure 4) north of Burgos (in region 1a).

Most of these wells are located in a comparatively small area on the anticlinal structures of Zamanzas (Nos. 2, 3, 4, 5, and 7) and Dobro (No.6). In addition there are the Leva, Canales and Huidobro structures, not as yet mechanically explored. A well is now being started in the same region near Soncillo to investigate the Leva anticline.

Perhaps the most interesting of all of CAMPSA's structures in Zuazo de Cuartango, also located in Region 1a, but farther east, between Vitoria and Orduña. This is a great cup-shaped anticline, whose lowest outcropping formation is the Turonian, and which has a good geological background, the Lower Cretaceous being very heavy at this point. Exploration calls for much heavier equipment than CAMPSA now has, and there has therefore not yet been any mechanical investigation.

No. 8 well was on the Zuazo structure, sort of a twin to the Gastiain, or Apodaca, as it is now called, belonging to CIEPSA,

Fig. 1 Petroliferous regions of the Iberian peninsula.

and located more to the east in the same geological district. This structure has just started producing gas in quantities and at pressures thought to be of industrial promise. There is accordingly much optimism about the future of the Zuazo structure.

Finally, CAMPSA has a series of concessions in other regions that may also prove of interest but where there has not been any drilling.

CAMPSA is now about to conclude an agreement, if it has not already done so, with VALDEBRO, for joint exploration of the former's concessions. In this way it is hoped to assemble adequate equipment for investigation of the great Zuazo structure.

The geological surveys conducted by

Fig. 4 Principal Exploratory Wells Drilled Since 1940.

1. *Campsa—Tudanca*
   Famanza I
3. *Campsa—Famanza II*
4. *Campsa—Famanza III*
5. *Campsa—Peña Ortún*
6. *Campsa—Dobro*
7. *Campsa—Srillanuesa de Rampalay*
8. *Campsa—Debita*
9. *Ciepsa—Oliana*
10. *Ciepsa—Burgo de Osma*
11. *Ciepsa—La Marina*
12. *Ciepsa—Rojles*
13. *Ciepsa—Boltaña*
14. *Ciepsa—Funiga*
15. *Ciepsa—Apodaca*
16.–19. *Adaro—Baeza-Bailén*
20. *Adaro—Chiclana*
21. *Valdebro—Sondeo de Marcilla*
22. *Valdebro—Sondeo de Castilfrio*
23. *Valdebro—Sondeo de San Lorenzo*
24. *Valdebro—Sondeo de Iglesias*
25. *Valdebro—Sondeo de Puigreig*
26. *Valdebro—Sondeo de Dobro*

Others

27. *Ampurdán*
28. *Laño* (*Ciepsa*)

Exploratory Drilling by CIEPSA[1]

Well	Total Depth (Meters)	Results	Remarks
Oliana	2,223	Dry	Began and bottomed in Upper Eocene.
Burdo de Osma	2,212	Dry	Bottomed in Buntsandstein. Schumberger neg.
La Marina	1,610	Dry	Bottomed Triassic. Schlumberger neg.
Rojales	1,582	Dry	Bottomed Triassic.
Boltana	2,124	Dry	Bottomed Maestrichtian. Schlumberger neg.
Zuniga	3,126	..	Drilling suspended pending heavy rig.
Apodaca	..	Dry	TD about 2,372 m. in lower Cretaceous.

[1]Well locations shown on Figure 4.

Exploratory Drilling by ADARO[1]

Well	Total Depth Drilling	Results	Remarks
Baeza	410	Gas	Bottomed in Keuper. Gas shows 270, 275, 365 m.
Chiclana	Drilling	Oil shows	Shows at 120 m. in Cretaceous at 1,000 m.

Three wells were drilled between Baeza and Bailen. No. 2 found gas in the Miocene before entering Triassic, in which formation it bottomed at 640 meters. Nos. 3 and 4 entered Triassic after faint gas shows and bottomed in Paleozoic.

[1]Well locations shown in Figure 4.

Exploratory Drilling by VALDEBRO[1]

Well	Total Depth (Meters)	Results	Remarks
Marcilla	3,415	Dry	Light rig unable to go thru Oligocene.
Castilfrio	2,400	Dry	Bottomed in Paleozoic.
San Lorenzo	2,580	Dry	Bottomed in Triassic.
Iglesias	2,180	Dry	Bottomed in Silurian.
Puigreig	..	..	Drilling in Upper Eocene at 1,170 m.
Bornos	..	..	Drilling at 1,050 m.

[1]Well locations shown in Figure 4.

Fig. 2 Location of Principal Exploratory Wells Drilled Before 1940.

CIEPSA are the most important that have yet been carried out in Spain, in both thoroughness and extent.

CIEPSA holds licenses covering 1,404,700 acres, It has two drills, a rotary by Continental-Emso of 8,000-9,000 feet capacity and a German rotary of 12,000 feet capacity. It has just acquired some powerful American drilling equipment for purposes of exploration in the Gastiain area.

The Oliana drilling was preceded by a geophysical survey. But it has only been since its association with Deilman that intensive and regular geophysical survey activity has been carried on, with two seismic reflection units, one by Deilman and one by Prakla. These units are being used to construct a dense network of profiles traversing the concessions and interconnecting them.

There has been detailed studies of the microfaunas of the Oliana, Burgo de Osma, Rojales and La Marina drillings by the expert G. Colom, and of the Apodaca and Zúñiga by Deilman specialists.

ADARO's activities in connection with hydrocarbon began towards 1943, when a number of prospecting licenses were taken out in the Pyrenees (region 1b), in the Iberics (region 2), and in the Béticas and the Guadalquivir valley (regions 7 and 8).

ADARO is better supplied with equipment than CIEPSA, employed in its various prospecting operations and pooled with that of VALDEBRO. It has several light drills of 700 meters range, two 1,200-meter Svenska rotaries, one Foraky rotary for continuous coring able to reach 1,500 meters and one Haniel-Lueg rotary able to reach 1,300 meters.

It has one seismic reflection outfit for geophysical prospecting, and through its association with the AGIP, it also has an Italian outfit working regularly in the Guadalquivir valley.

In the zone of the old Spanish Protectorate of Morocco, where work had previously been done in a sporadic manner, an agreement was made between the INI and the Sherifian government to continue hydrocarbon prospecting in two reserve zones, the western 1,227,590 acres and the eastern 575,510 acres in area. These zones cover those areas of the pre-Riff that contain—rather sparse—signs of petroleum. Geological and geophysical surveys were made which, between 1945 and 1947, led to seven wells on the Jemis del Sahel structure, to depths ranging around 212 to 350 meters (one is 47 meters).

The general arrangement is one of a shallow Miocene resting on the Upper Triassic (Keuper of German facies). Four drillings have produced outbursts of gas and some sign of oil, but nothing of commercial value. An eighth well, begun in 1955 on the Dchar Yedid structure, which is a saline chimney of Keuper cropping out between Miocene and Eocene, has not left the Miocene and reached a depth of 102 meters.

The similarity of conditions in the Po valley as previously mentioned in our de-

scription of the features of the several regions suggested a liaison with the young and powerful natural gas industry of Italy, and cooperation was set up with the Italian government's AGIP Mineraria. In consequence, a program of geophysical surveys was planned, and is now well advanced.

VALDEBRO's activities began with an initial grant for prospecting of a concession at Marcilla (Navarra, region 4). This grant was afterwards amended and extended on several occasions, as regards both capital investment and areas placed at VALDEBRO's disposal. It has two rotary type units by American Oil Well—Emsco, one model J-1100 set up to reach 4,000 meters but with a capacity range of 5,000, and another model GC-500 for 3,000-3,500 meters. It is arranging to import another unit to speed up the progress of exploration. Also, its equipment is pooled with that of ADARO.

It has two seismic reflection prospecting outfits. The following geophysical surveys have been made: 1) Marcilla structure with Geophysical Service Inc. outfit, two months in 1942-43; 2) Bugos area, upper Duero valley, with Precision Exploration Co. outfit; 3) Cuenca zone, to study area of San Lorenzo de la Parrilla structure, with same outfit; 4) areas adjoining the lower Guadalquivir valley with same outfit; 5) middle Ebro valley survey, now in progress.

The Geological Institute conducts various gravimetric surveys for VALDEBRO.

VALDEBRO has engaged the Mining and Geological Institute to carry out a series of gravimetric surveys, work to date having been done in the Guadalquivir valley, central portion of Ebro valley, middle portion of Ebro valley, region adjoining Puigreig, and Marcilla region, where work is now going on.

Other Activities: While the foregoing are the major operations, there has been no lack of activity by smaller enterprises on their several concessions.

A well was drilled by the Geological Institute near Soria (region 2), beginning with the upper portion of the Albian-Wealden and ending at about 700 meters without leaving that formation, with negative results.

Three wells have been drilled at Zumaya on the Cantabrian coast between San Sebastian and Bilbao (region la). Results have not been published, but apparently 700 and 1,000 meters was reached, and at least one is understood to have struck gas under high pressure. They began from the highest part of the Upper Cretaceous, and in all likelihood never left it.

The Sociedad Petróleos Españoles drilled the La Bisbal well in the northeast of the province of Gerona near the Mediterranean coast (region 3). It reached 609 meters and stopped in Paleozoic formations after traversing the Eocene series, practically complete. 50 meters of basal limestones showed indications.

The Sociedad LECSA, Orovio, sank another well at Riumors, not far from the preceding and stopped on account of breakdown at 435 meters without leaving the initial Pliocene formations. Results were negative.

Fig. 3. Oil Concession Map. All Areas outside indicated Concessions are Reserved to the Government.

The two companies have just combined to carry on their activities joint.

There has been a number of other minor projects without technical or financial backing.

It is obvious there remains much to learn about geology, and geophysicists must have far more statistical data in order to reach accurate conclusions. More drilling equipment is needed, and capital will have to be poured into these investigations. There is little reason to be discouraged by the accumulation of partial failures as the history of oil prospecting in many countries that are producing today will show.

One adverse factor is that, what with shortage of equipment and eagerness for results, investigations (taking those of all organizations as a whole) still suffer from lack of system. Drills are moved from one zone to another at the first sign of failure, when far from having been exhausted, potentialities have hardly yet been tapped.

If CIEPSA's optimism regarding industrialization of the gases found in the Zuniga well should prove justified, Spanish exploration will have taken the first step forward to investment for further exploration maybe forthcoming.

SUMMARY BIBLIOGRAPHY

1) Almela, A., "Las investigaciones petrolíferas en la vertiente Sur-Pirenaica" (Oil prospecting on the Southern Pyrenean slopes), *Pirineos* 1954, No. 31-32, Zaragoza.

2) Anon, "Oil in the Western Hemisphere: Western Europe - Spain", *The Petroleum Times*, April 3, 1953, London.

3) Bentz, A. "Petróleo en Alemania" (Oil in Germany), introduction by J. M. Ríos, *Not. y Com. del Inst. Geol. y Min. de Espana* 1946, No. 15, Madrid.

4) CAMPSA, "Prospección petrolífera" (Petroleum prospecting), bulletin published in 1953, Madrid.

5) CEPSA, "La labor de la Compañía de Investigaciones y Explotaciones Petroliferas S.A." bulletin published in 1953, Madrid.

6) Dupuy de Lôme, E., Sr., "Las investigaciones de petróleo en España" (Oil surveys in Spain), *Bol. Inst. Geol. y Min. de España 54* (1937), Madrid.

7) Dupuy de Lôme, E., Sr., "Terrenos petrolíferos españoles" (Oil lands in Spain), *Bol. Of. de la Dir. Gen. de Min. y Comb. 21*, No. 237 (Feb.-March 1937), Madrid.

8) Dupuy de Lôme, E., Jr., "Un aspecto de las investigaciones petrolíferas en España" (A view of petroleum surveys in Spain), address on occasion of 175th anniversary of the Madrid School of Mines (in press).

9) Garrido, J., "La prospeccíon de petróleo en España" (Oil prospecting in Spain), *Combustibles (Inst. del Combustible) 7*, (1948), Nos. 45 and 46, Zaragoza.

10) Gavala, J., "Regiones petrolíferas de Andalucía" (Oil bearing regions of Andalusia), *Bol. Com. del Mapa Geol. de España 37* (1916), Madrid.

11) Gavala, J., "Yacimientos de petróleoen Huidobro (Burgos)" (Oil beds at Huidobro (Burgos), *Bol. Inst. Geol. y Min. de España 37* (1916), Madrid.

12) Marin, A., "El problema del petróleo en España" (The petroleum problem in Spain), II Congreso Nacional de Ingeniería, Paper No. 241, 1950, Madrid.

13) Ríos, J. M., "Las investigaciones de petróleo en España" (Oil surveys in Spain), *Not. y Com. del. Inst. Geol. y Min. de España* 1949, No. 19, Madrid.

14) Ríos, J. M., "Breve noticia del estado actual de las investigaciones del petróleo en España" (Brief report on present status of oil prospecting in Spain), VII Convegno nazionale del Metano e del Petrolio, Section 1, 1952, Palermo.

15) Ríos, J.M., "Marcha de las investigaciones de petróleo en España: 1952-1955" (Progress of oil prospecting in Spain, 1952-1955), *Combustibles 15* (1955), No. 78/9, Zaragoza.

16) Ríos, J. M., review of article by H. D. Hedberg on world oil prospects from the point of view of occurrence of petroleum, *Not. y Com. del Inst. Geol. y Min. de España* 1955, No. 39, Madrid.

17) Sanz, R., "El petróleo en España" (Oil in Spain), *Mem. del Inst. Geol. y Min. de España* 1948, Madrid.

18) Sampelayo, P. H., "Aportación a la bibliografía del petróleo en España (Contribution to the bibliography of petroleum in Spain), *Not. y Com. del Inst. Geol. y Min. de España* 1946, No. 15, Madrid.

19) Sondeos, Comité Nacional de, "Catalogación provisional de los sondeos efectuados en España" (Tentative list of drillings performed in Spain), 1929-1932, Madrid. END.

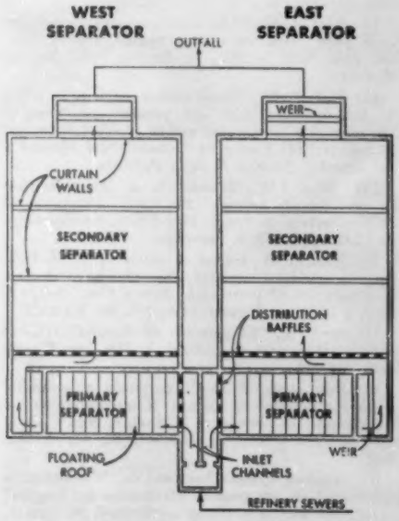
Union Oil Company's waste water processing facilities at its Los Angeles refinery.

UNION OIL COMPANY Builds New Waste Water Facilities

By Gordon W. Brown and James E. Sublett

THE Union Oil Company of California has installed at its Los Angeles refinery new waste water facilities designed to process 50,000 gallons per minute of waste water. An unusual feature of this installation is that they include covered primary separators which essentially eliminate evaporation losses and air pollution.

The Los Angeles refinery has a capacity of 110,000 barrels per day of crude oil and is situated on 450 acres of land adjacent to the Los Angeles Harbor. Wastes originate from various refinery processes including fractionation, cracking, reforming, isomerization, alkylation, chemical treating of oil stocks, sulfur and ammonium sulfate manufacture; from operation of utility and service facilities and from maintenance and repair activities. All process water from these facilities and a major portion of the surface drainage flows through the waste water processing facilities.



Schematic plan of the waste water facilities.

The flow of waste water has increased considerably with refinery expansion during the past twenty-five years. In order to reduce the possibility of air or water pollution from refinery waste waters, and also to conserve potential oil losses, a decision was made in 1952 to rebuild the existing facilities.

At that time, the waste water processing facilities included two separator systems operating in parallel. Each system consisted of a primary separator in series with a large baffled basin. This system was effecting a satisfactory removal of oil during normal flows of water. However, during certain turnaround periods and rain storms, the primary separators were not satisfactory. Considerable amounts of oil were carried out to the secondary separator increasing the work load on the operating personnel. In addition, from an air pollution control standpoint, they had also become unsatisfactory. This was because of changing standards in the Los Angeles Basin rather than any fundamental change in refinery operations.

To alleviate these problems, the Union Oil Company designed and installed facilities to meet the following objectives:

1. Increased efficiency of waste water processing.
2. Substantial reduction of air pollution from hydrocarbon evaporation.
3. Automatic effluent pH control.
4. Continuous treatment of emulsions.

Design of System: The new waste water facilities are comprised of two identical parallel systems which have a design capacity of 50,000 gallons per minute of water. Each system consists of a primary and secondary separator in series as shown in Figure 1, Schematic Plan. Essentially all the oil and emulsion separates out in the primary separator. The secondary separators provide additional residence time for separation of the last traces of difficult emulsions, provide a factor of safety for high water rates, and act as fire water reservoirs.

The primary separator was designed in accordance with the basic principles recommended by the American Petroleum Institute.[1] However, there are two main differences as compared to the conventional API separator: first, a flight scraper is not utilized, and second, the primary separator is completely covered to minimize the evaporation of hydrocarbons to the atmosphere and reduce air pollution.

The primary separator is 140 feet long, 40 feet wide, and eight feet deep. It is divided into two 20-foot channels by a longitudinal partition as indicated in Figure 3. Each separator is covered with eleven rectangular-shaped pontoon roof sections. Each roof section is 12 feet long, 40 feet wide, and 2 feet thick. The roof is so de-

(1) American Petroleum Institute, *Disposal of Refinery Wastes*, Volume I: Waste Water Containing Oil, 5th Edition.

Gordon Brown was graduated from the University of Southern California with a B.E. in Chemical Engineering in 1951. He joined Union Oil Company the same year. He has worked in laboratory, process engineering, and at present is operating engineer in the asphalt/refined oil department.

James E. Sublett, Jr. is a process engineer with Union Oil Company of California at its Los Angeles refinery. He joined the company in 1951 following his graduation from the University of Southern California with a B.E. in Chemical Engineering. Prior to his current assignment, he spent three years as an engineer in the bulk operations department where one of his responsibilities was the supervision of the operations of the refinery waste water handling facilities.

signed to always remain in contact with the liquid surface. Although the roof is of pontoon construction, it floats only during high water rates. The last roof section supports rotatable slotted oil-skimming pipes through which oil and emulsions are removed from the separator.

Each secondary separator consists of earthen-walled basin with inlet distribution section, oil-retention baffles, and oil-skimming equipment. The secondary separator is 350 feet long, 150 feet wide, and eight feet deep. Curtain walls, extending two feet six inches below the surface, were installed at three locations to aid in the gathering and skimming of the emulsions. A floating wooden boom is pulled manually to gather emulsions which rise between each curtain wall. Emulsions are removed with the aid of a floating self-adjusting skimmer.

All recovered oils and emulsions are transferred to tankage by steam reciprocating pumps. Mild steel was used in all phases of construction; i.e., roofs, pipe lines, valves, etc. No corrosion problems of any significance have been encountered.

Waste Water Separator Operations: The waste waters join upstream of the two parallel systems in a covered concrete collection box. This collection box is 46 feet long, four feet wide, and eight feet deep. Water from the collection box then flows by gravity to the two parallel primary separator distribution boxes. It then enters the primary separator settling section where the residence time is approximately 90 minutes for normal flow. Oil and emulsions are continuously skimmed from these sections through the slotted pipe skimmers which extend the width of the separator. More than 99% of the incoming oil and emulsions, approximately 700 b/d, separate from the water in the primary separator. The recovered oil and emulsions are pumped to a settling tank. Tests indicate that there are no measurable hydrocarbon losses to the atmosphere from the covered primary separators.

Water containing 30-35 parts per million oil, flows over the primary separator weir into the secondary separator distribution box and then into the settling section. Residence time in the secondary separator is approximately 14 hours for normal flow. This allows ample time for the carried-over emulsions to become disengaged from the water. Emulsions are skimmed off once a day and pumped to a settling tank. Water containing only dissolved oils then flows over the outfall weir to the West Basin of the Los Angeles Harbor.

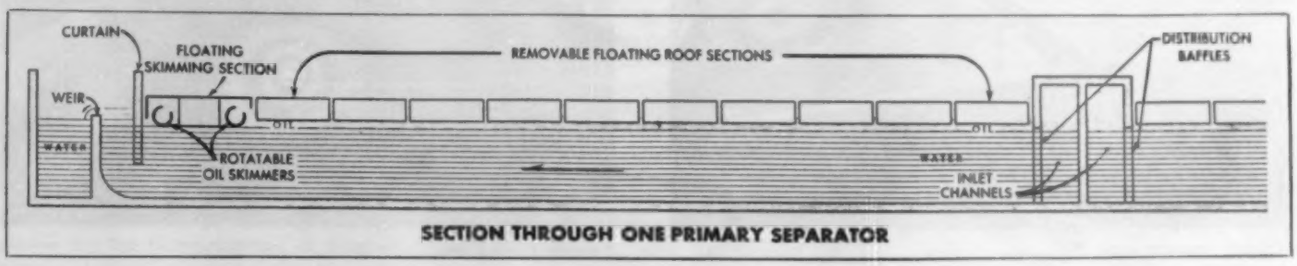
The normal water flow through the waste water facilities is approximately 8,000 gpm. During periods of rain storms, rates of 30,000 to 35,000 gpm have been experienced with only slight increases in oil carryover from the primary separator. No increase in oil content has occurred in the water from the secondary separators. Water in excess of that which may be handled by the primary separators can be diverted to a storm pit. When the waste water rate returns to normal, the excess water in the storm pit is returned to the sewer collection box.

Although the refinery handles sulfide bearing crudes, the outfall water is normally free of sulfides. This is maintained by handling those process waste water streams high in sulfide content, in an independent collection system. The water is released to the sewer only after extensive stripping action. During periods when stripping units are upset, dilution of residual waters with salt water from a separate system effectively reduces sulfide concentrations. In addition, some reduction in sulfide content occurs through aeration and oxidation as the water goes over weirs and through the secondary separators.

The pH of the waste water entering the separators is controlled between 6.5 and 7.5. This is necessary to control the effluent pH and to prevent excessive corrosion. The pH of the influent water is measured by pumping a sample through a glass electrode cell. Whenever the pH is outside the permissible operating range either spent acid or caustic is automatically added at the main sewer collection box. To prevent fouling of the glass electrode cell from oil, a 10-foot section of 8-inch pipe was installed upstream of the glass cell. This horizontal baffled pipe allows the oil and emulsions to separate from the water.

Oil Recovery Operation: Normal operation of the oil-recovery system is to pump all the recovered oil and emulsions to the primary stage settling tank as shown in Figure 3. Here the recovered oils split into three phases due to gravity: dry oil, emulsion, and water and sediment. The top phase, dry oil, contains two percent or less of water and sediment and is pumped out automatically to storage as it accumulates. The middle phase, emulsion, is removed continuously and pumped through a de-

Section through one primary separator.



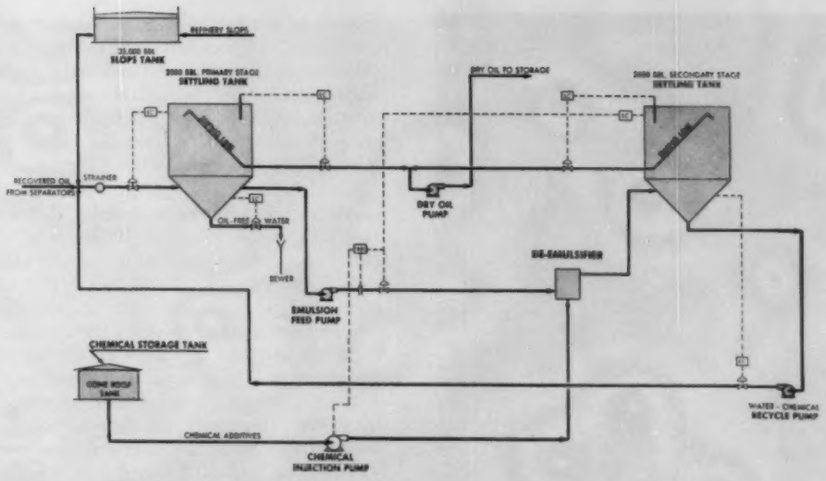
SECTION THROUGH ONE PRIMARY SEPARATOR

emulsification unit,[2] to the secondary stage settling tank for final separation. The bottom phase, water and sediment, is returned to the primary separator. Unique in the design of this oil-recovery unit is the application of an interface detection instrument which permits the automatic recovery of dry oil as it accumulates in the settling tanks.

The oil-recovery system has a capacity to treat 2,000 barrels per day of emulsions. During periods when the emulsion recovery rate is higher than the oil-recovery system can handle, the excess is diverted to a 35,000 barrel floating roof storage tank. In addition, this tank receives slops from other sources in the refinery including tank bottom sludge, ship ballast containing oil, wet crude bottoms, etc. Clear water is withdrawn periodically from the bottom of the tank. Oil which has risen to the top of the tank is periodically pumped to storage for refractionation. During periods of low recovery rates from the waste water facilities the emulsion from the storage tank is put through the de-emulsification unit. Several types of chemical-emulsion breakers are continuously mixed into the fresh emulsion which effectively reduces the emulsion to dry oil and water sediment. To date, this process has treated over 750,000 barrels of all types of emulsions on a once-through basis.

Maintenance: It has been necessary to shut down each separator system once a year for clean-out of the primary separator. Over a period of time, dirt and coke settle in the primary separator distribution box and settling chamber. Large accumulations of this material effectively reduce the residence time of the influent water and thereby increase secondary separator operations which are more laborious. Repairs to equipment have all been minor. END

(2) This de-emulsification process is licensed by the Union Oil Company of California.



Simplified flow diagram of the emulsion treating unit.

The primary separation inlet distribution baffle.

Primary separator outlet Weir.

Emulsion treating unit.

Rationing Plans Prepared in Europe For Possible Suez Shut-Down

Industry and government officials in England and on the continent study alternative plans for meeting possible emergencies if negotiations with Egypt result in closing or curtailment of Suez operations.

THERE is a good deal of midnight oil being burned in London and on the Continent as industry planners study what steps should be taken in case the worst is realized and Suez is closed to oil traffic. Rationing would be inevitable, at least to some extent, if the canal becomes inoperative and in England and France particularly, arrangements are well advanced to implement rationing procedures.

Current studies are of great complexity since there is no knowledge as to whether other Arab states might interfere with oil production and pipeline transportation, and to what extent such interference might dry up deliveries from Iraq and Saudi Arabian fields to eastern Mediterranean pipe line terminals. There was one brief demonstration on the part of labor when the crisis first arose but it was of no real importance in halting oil movements.

Students of the situation always are confronted with the attitude of the Arabs toward the Israelis and the extent to which the boycott has been made effective at the expense of important revenues. For some years now Iraq has prohibited the movement of oil by pipeline to Haifa. Lines to the refinery there and to the port have been cut so that there can be no suspicion on the part of the Iraqi that oil is being shipped into Israel. The embargo over a period of years has cost the Iraq treasury many millions of dollars in oil revenues.

With this example in mind, there is some real basis for fears that the Arab states might act as a unit and be willing to accept a severe financial loss in order to support the Egyptian action.

On the other hand both Iraq and Saudi Arabia have undertaken great public projects and both the rulers and oil workers have become accustomed to a much higher standard of living as a result of oil. Doubt exists in the minds of many that Saudi Arabia would long be content to exist on the revenue provided by pilgrims to Mecca on which the country largely relied for foreign exchange prior to oil.

The rulers themselves doubtless have amassed cash reserves which would care for their needs and those of their households, and a return to lower standards for the people and abandonment of public works might be feasible if public opinion against the West is sufficiently aroused.

Leaders in the Arab world now have in mind the effect on the economy of Iran caused by the nationalization of Anglo-Iranian Oil Co. properties. They have seen that the world can do without the oil of any one or two oil producing countries and that the cutting off of oil revenues can indeed be a disaster. This is not to say, of course, that given enough emotional impetus such a shut-down in one or more countries is not possible.

Assuming willingness of Iraq and Saudi Arabia to produce and ship oil there is the attitude of Syria and Lebanon to be considered. These states now are in a controversy with the oil companies regarding pipe line taxes and revenues and an interruption near the end of existing lines might be undertaken as a means of supporting Egypt and at the same time seeking to force larger pipe line payments. The nationalization of part of one line already has been proposed.

Still another complication might be a slowing down of canal operations as the result of inefficient operations by Egyptian personnel and a shortage of foreign employees. Thus far, there have been no traffic delays of importance but such delays may well begin to appear, particularly since many of the 200 foreign pilots have left their jobs.

There are about 40 Egyptian pilots employed on the canal but only three are qualified to guide ships of more than 15,000 deadweight tons through the big ditch. No Egyptian pilot is licensed for supertankers of unlimited tonnage and maximum draft. Under company rules, a Suez pilot must have a master's license and must serve an apprenticeship of two to three years before he is deemed qualified to guide ships of less than 12,000 dwt. From 7 to 10 years' experience is required usually before vessels of 25,000 tons may be piloted. Added years of experience in the sandy canal are necessary for an unlimited license.

The canal presents difficulties because of its shape, depth and the character of its banks. The canal is about 190 feet wide except at the curves. The usual depth at the center is about 38 feet. Tankers drawing up to 35 feet may have only about 25 feet of deep channel on each side of the center line in which to maneuver. Once off center for any reason differential pressures cause vessel swinging.

Vessels move through the canal at low speed but even so the movement of the ship displaces enough water ahead to lower its level as much as three feet below the ship and the wake diminishes the effect of the rudder. This is particularly true in the case of twin-screw vessels which require the most meticulous guidance to avoid piling up on the shore. This is true because of the difficulty in keeping the speed in both propellers the same. In any case, pilot action must be swift and sure since the narrowness of the channel allows only a few seconds in which to correct any swing away from a true course.

Under present canal rules, loaded tankers are permitted a maximum speed of seven knots. This is necessary to prevent undue washing of the banks and filling of the channel with sand. A convoy system is employed and groups of ships move in a single direction at one time. Tankers start at a set time and other smaller vessels leave Suez an hour and a half later, being allowed a forward speed of eight knots.

Aside from tidal action there is little current in the canal but the tide has a speed of about 2½ knots and this is complicated in certain seasons by severe sand storms which may reduce vision to a dangerous point. Cross winds require special handling of vessels to prevent disaster. Any pilot error in a cross wind may put a vessel across the canal and tie up the artery for hours or a day or more.

Because of the recent tendency for foreign pilots to leave their posts or to request repatriation, the Egyptian Government has undertaken a recruiting program among experienced pilots in other countries. For example, a drive is underway among the 200-odd pilots serving the Kiel Canal and among the 90 pilots at the Elbe. These are under contract to give three months notice of intention to resign and thus far it is said that none has given such notice. The West German government is said to be opposed to permitting its pilots to go to Egypt. In the first place, the government does not wish to run counter to the wishes of the British and French whose pilots now are largely engaged at Suez. Secondly, it is feared that any large movement would hamper North German shipping.

Recruiting is not confined to Germany. Pilots in other sections of Europe, in Asia and in the Western Hemisphere have been invited to apply. Russian, Italian, Indian and American pilots are said to have been encouraged to apply for berths by liberal pay and allowances. Earnings as high as $1,400 per month are reported possible if enough trips can be made. Of this, Egypt

(Continued on page 99)

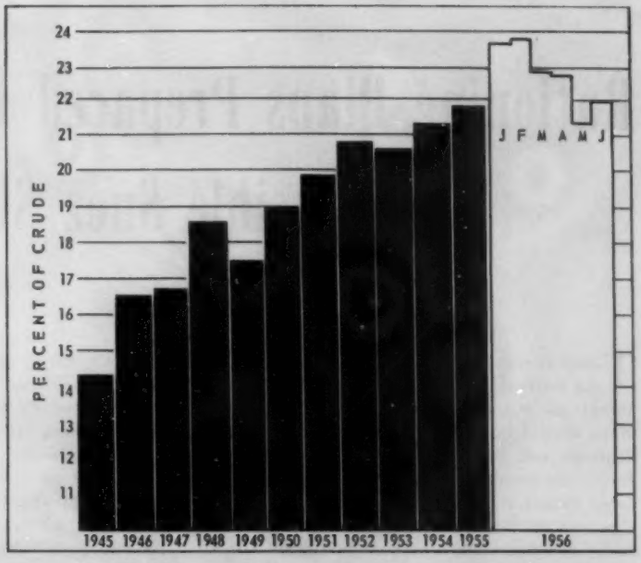


Fig. 3. Refinery yields of middle distillates stood at 22.8% for the first half of this year, about 50% increase over yields at the end of World War II.

MIDDLE DISTILLATES SALES UP

The middle distillate market increased about 12% in the first half of 1956, with 336,894,000 barrels of distillate fuel oil sold. Oil heating installations are below the previous year, however, and railroads use of diesel oil is expected to level off soon due to increased use of heavier fuels, both for reasons of economy and new gas turbine design.

Fig. 5. Shown is the artist's conception of the new Union Pacific gas turbine-electric locomotive built by General Electric Co. 45 of these 8,500 hp units have been ordered. They may cause a change in the pattern of railroad consumption since they operate on Bunker "C" residual fuel oil.

FUEL OIL distributors and sellers in the U.S. enjoyed their third best year in 1955. Fueloil and Oil Heat magazine reports 808,805 new oil heating installations during 1955, as compared with 738,048 installations in 1954. Of the 1955 total, 689,322 were new customers, while the industry lost 76,067 old customers to new fuels, leaving a net gain of 613,255.

The rise in installations during 1955 was chiefly due to new home business. While total installations were up 9.6% over 1954, new home oil heating gained 18.5%. Oddly enough, the midwest region accounted for the strongest single gain, although all regions sold more installations in 1955 than in the previous year, with the exception of the mid-Atlantic region. The midwest strength occurs in the area where natural gas prices are the lowest and competition, therefore, is sharp but cannot add new users, and many new homes are off the gas mains.

A survey conducted by Fueloil and Oil Heat reports that first half preliminary shipment figures for new installations are down this year, however. New burners sold separately, boiler burner and furnace burner units were 295,533, or about 18% below first half shipments during 1955.

July oilheating installations this year dropped about nine percent from the July total last year, to an estimated 62,089 units, according to Fueloil and Oil Heat. Installations in the first seven months of 1956 are continuing to run below 1955 levels, and are estimated at 331,571 units, against 361,521 in the corresponding period a year ago.

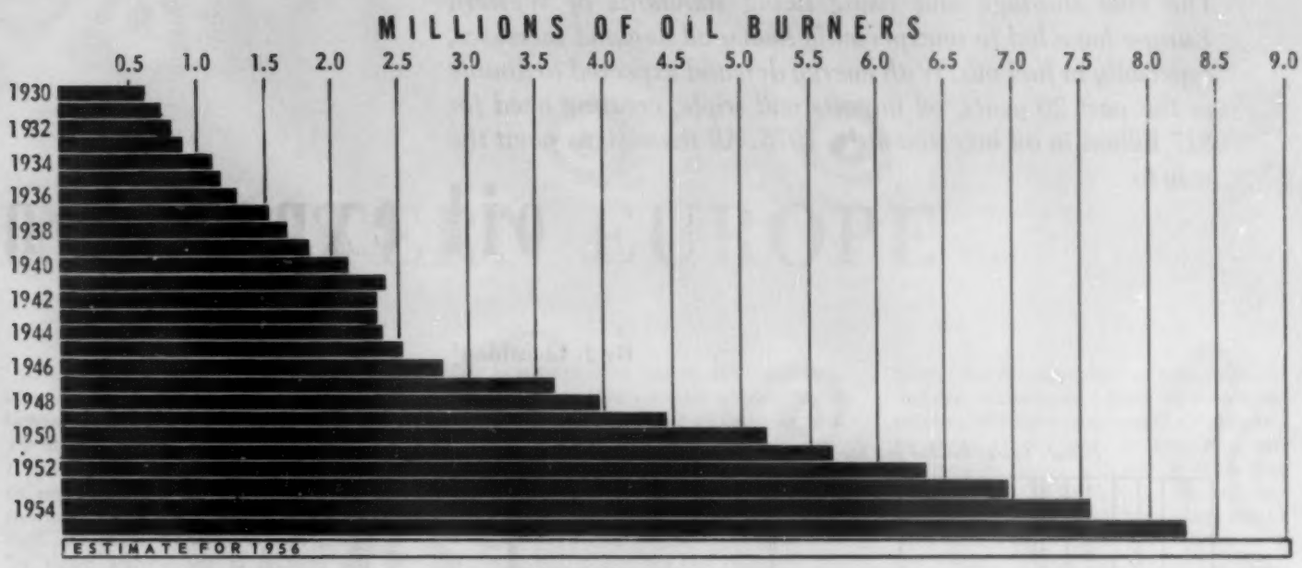


Fig. 4. Oil burners in service are expected to increase to about 9,106,260 this year, based on the first half year's figures. Installations are running below 1955, however, which was the industry's third best year.

Factory stocks amounted to 32,696 units on May 31, compared with 71,794 a year earlier, according to the latest available Census Bureau figure. Factory shipments this year have shown a much greater drop than field installations but shipments of commercial-industrial oil burners in the first half of this year are running about 117% above 1955. June shipments were 3,065 units, and for the first six months, amounted to 15,885 units.

The reasons most often given for the decline in use this year are the wet weather, which has held up new building and delayed many shipments, the lack of mortgage money for financing new houses and competition from natural gas.

Installations during the second half of the year are normally three times those in the first half. If this rule of thumb is adopted it is estimated that 1956 installations would raise the total of oil burners in use in the United States to roundly 9,141,200. Losses to other fuels are estimated at around 2.4%, and replacements at around 100,000.

To meet the threat posed by the growing encroachment of gas use, the industry has adopted a nation-wide campaign to stimulate the use of oil in heating installations. From local campaigns such as was waged in Boston last year (WORLD PETROLEUM, October, 1955), the industry has extended a cooperative advertising program to 36 oilheating markets around the country. One is in progress at present in the Hartford, Connecticut, area which will eventually cover the entire state.

U. S. OILBURNER INSTALLATIONS

Burners in Use 1/1/55	7,841,973
New Homes	376,199
Replacements	119,483
Conversions	313,123
Total	808,805
Losses to Other Fuels	76,067
Burners in Use 1/1/56	8,255,228

Major oil companies are backing the effort. They meet with local groups to determine the need in the area being surveyed. They then prepare reports with the aid of the local group dealing with their growth and position in the market. 60% of the campaign's financing is met by the local group, the remainder by the oil companies.

A number of these companies sponsor a coordinating office to help supply the necessary information upon which they can base decisions. This central coordinating office prepares a market analysis, on specific cities or regions being considered for promotional programs. It also gathers from all parts of the country effective advertising materials and reproduces these for distribution to all interested groups to help their own thinking as they prepare programs.

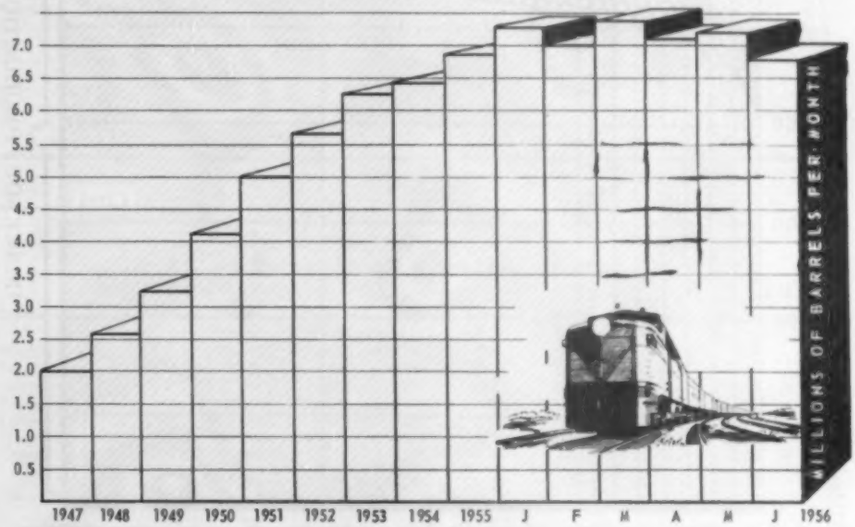
The local committee handles every phase of the advertising and promotional program and, of course, the major companies are able to help on this because of the background of advertising and public relations in their parent organizations.

The new central coordinating office is "Oilheating Market Reports" at 2 West 45th Street, in New York. The individual responsible for the operation is Robert Gray, editor of Fueloil & Oil Heat.

The consumption of distillate fuels is rising in Europe even more strongly than it is in the United States. This is expecially marked in case of distillate fuel oil used for space heating, where the number of units

(Continued on page 52)

Fig. 2. United States railroads increased their use of diesel fuel by about 10% during the past year. 1956 use is also higher, reflecting the increased number of diesels put into service.

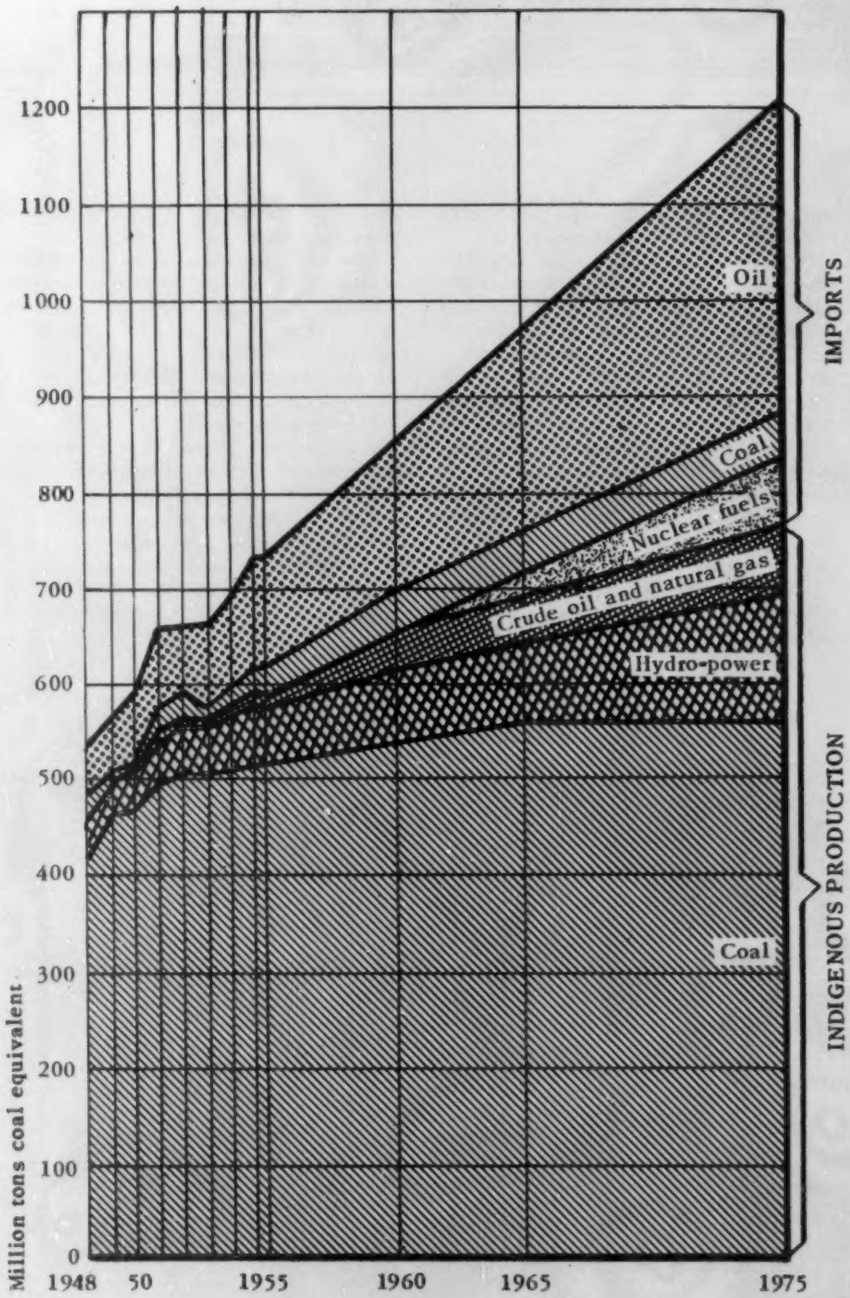


The coal shortage and rising living standards of Western Europe have led to unexpectedly heavy oil demand increases, especially in fuel oils. With energy demand expected to double in the past 20 years, oil imports will triple, creating need for $17 billion in oil investment by 1975. All these signs point the way to

oil expansion

By J. Lichtblau[1]

Primary Energy Demand and Supply in the O.E.E.C. Area



THE rise in oil consumption and processing in Western Europe has been one of the outstanding features of that area in the ten years since the end of World War II. It has brought with it profound changes in the world oil industry, the most important being the meteoric rise of the Middle East to the position of the world's major oil exporter, which would not have been possible in such a short period without the oil-starved markets of Western Europe.

To some extent this increase in demand is due to the postwar industrial expansion in Western Europe, its rising standard of living and its natural population increase. Total energy consumption (coal, water-power, oil, natural gas) in the area has risen 28% between 1937 and 1955, from 570 million tons of coal equivalent to about 730 million tons and per capita consumption of energy has increased only 10.5%, from 2.28 tons of coal equivalent in 1937 to 2.52 tons in 1954. Obviously then, the main reason for the rise in oil consumption was the shift from coal to oil in the European economy.

Much has already been written about this shift. Its main causes are the inability of most European coal mines to sufficiently expand production, the greater efficiency of oil as a heating fuel, and the price advantage of oil over coal, measured in calorific content. The growth of the European motor vehicle sector, stimulated partly by the large-scale introduction of consumer installment purchases, has also contributed to the rise in oil consumption, although to a lesser extent than the shift from oil to coal.

How rapid this change has been within the postwar period is clearly illustrated in Table I showing fuel consumption for the 16 countries of the Organization of the European Economic Cooperation (OEEC).

The outstanding fact about Table I is the uninterrupted decline in the share of coal since 1937 and the equally uninterrupted increase in the share of oil. Percentage wise, the increase is even sharper for natural gas but its share in the total is still less than 1%, equivalent to only 70,000 b/d of oil products. The bulk of it—about 86%—is produced and consumed in Italy.

The growth of Europe's oil industry over the past five years, the period following the end of the continent's reconstruction effort, is illustrated in Table II.

(1) Editor, Petroleum Industry Research Foundation.

IN WESTERN EUROPE

Crude oil is now produced in significant quantities in the following countries:

Austria,	74,000 b/d	Netherlands	20,000 b/d
France	18,000 "	Germany	62,000 "
Italy	4,500 "		

Total of above countries is 180,500 b/d, of which 26,000 b/d of Austria's amount goes to the USSR for the next six years under the state treaty of 1955. The total proved reserves of these five countries amounts to about 850 million barrels, equivalent to 14 years' production at the current rate. Domestic crude oil output is thus of only minor importance in meeting Europe's oil needs since it accounts for only about 7.5% of the area's refinery throughput. Hence the increasingly heavy reliance on crude oil imports, of which 85% come from the Middle East. Europe's concern over the political stability in the Middle East can therefore be understood largely in terms of oil. Prime Minister Eden stated this fact very succinctly when he declared, "no Middle East oil—hunger and unemployment in Britain. It's as simple as that."

Products imports into Europe were also higher last year than in 1954, according to preliminary indications. Residual fuel oil and gas/diesel oil exports from the Middle East to west of Suez rose by 138% and 70% respectively to reach a total of over 70,000 b/d during 1955. The bulk of these exports went to Western Europe. Caribbean gas/diesel and fuel oil shipments to Europe amounted together to 168,000 b/d, a 40% increase over 1954. All these shipments were destined largely for consumption in sectors which previously had relied on domestic coal for their fuel needs.

The Soviet Bloc contributed a total of about 54,000 b/d to Western Europe's oil imports (exclusive of synthetic oil shipments from East to West Germany), apportioned as follows:

	Barrels Daily
Finland	18,660
Sweden	14,770
Italy	7,060
Iceland	5,280
Greece	3,900
France	3,300
Others	1,030
Total	54,000

Products exports declined sharply last year, mostly because of the virtual cessation of shipments to areas east of Suez following the reopening of the Abadan refinery and the activation of new refineries in Aden, Australia and India. At their high-point in 1953 these shipments had amounted to about 115,000 b/d. In 1954 they had declined to 90,000 b/d and in 1955 they averaged only 15,500 b/d. In the first four months of the current year they shrank further to 2,500 b/d. However, this loss of the market in each country east of Suez, was more than made up by higher domestic demands resulting in intra-European oil shipments of about 340,000 b/d last year.

Taking products imports and exports together, the OEEC area seems to have been a net importer to the extent of about 140,000 b/d last year, on the basis of still incomplete figures. It was a net exporter of motor gasoline, although on a very reduced scale compared to 1954, and a heavy net importer of fuel oils.

The internal consumption pattern within the OEEC area over the four years, 1951-1954 is shown in Table III.

Internal consumption figures for 1955 also reveal some interesting trends over the last three years. According to Table IV, all major products showed a sharper increase last year than in either of the two previous

TABLE I

Percentage Share of Primary Sources in Inland Energy Consumption

Year	Coal, Lignite	Water-Power	Natural Gas	Crude Oil	Total
1937	87.0	6.0	—	7.0	100
1948	83.2	6.5	0.1	10.2	100
1949	83.0	5.9	0.1	11.0	100
1950	80.6	6.8	0.2	12.4	100
1951	80.0	7.0	0.2	12.8	100
1952	78.8	7.4	0.4	13.4	100
1953	77.1	7.4	0.5	15.0	100
1954	75.0	7.8	0.6	16.6	100
1955 (Est.)	74.3	7.8	0.7	17.2	100

Source: OEEC

TABLE II

Europe's Oil Trade, Production and Consumption, 1951-55
(Thousands of barrels daily)

	1951	1952	1953	1954	1955*
Crude Oil Production**	67	77	98	116	154
Crude Imports	1,073	1,373	1,578	1,810	1,924
Refinery Output	1,077	1,320	1,544	1,773	1,932
Products Imports***	370	218	164	182	N.A.
Products Exports***	—	146	188	176	N.A.
Total Consumption	1,294	1,364	1,492	1,735	1,980
of which Bunker fuels	180	198	194	234	258

Source: OEEC
*Preliminary figures. **Excludes the share of Austrian crude oil going to the Soviet Union. ***Does not include trade between the OEEC countries.

TABLE III

Product Consumption in the OEEC Area 1951-1954

Product	1951		1952		1953		1954	
	Metric Tons	Barrels Daily	Metric Tons	Barrels Daily	Metric Tons	Barrels Daily	Metric Tons	Barrels Daily
Gasoline	15,670	313	16,596	332	18,072	361	19,673	393
Kerosine	3,088	62	3,224	64	3,278	66	3,446	69
Gas/diesel oil	12,271	245	13,352	267	14,725	294	17,082	342
Fuel oil	17,932	359	18,309	366	20,956	419	25,173	503
Lubes	2,196	44	2,088	42	2,221	44	2,375	47
Bitumen	2,363	47	2,424	48	2,864	57	3,191	64
Other Products	1,868	37	2,261	45	3,238	65	4,206	84
	55,388	1,108	58,254	1,165	65,354	1,306	75,146	1,503

*Barrel figures are approximate, converted at seven barrels per metric ton.

TABLE IV

Percentage Change in Inland Consumption Over the Previous Year

	1953	1954	1955
Motor Gasoline	8.4	8.2	9.1
Kerosine	15.3	12.7	17.7
Gas/Diesel Oil	10.3	15.9	17.6
Fuel Oil	14.3	20.1	23.4
All Products	11.9	14.7	15.9

years. Of special interest is the rise in kerosine consumption. About half of Western Europe's kerosine is consumed in Great Britain where its use as fuel for jet planes is the main reason for the revival of this product which until a few years ago was often referred to as a "dying" commodity. In addition to jet fuel use, there is also the factor of the cheapness of kerosine as a heating fuel compared to most other fuels, on a heat content basis. This has attracted some new users from the domestic boiler segment in Britain.

The percentage figures also point to one of the most persistent troubles of West European refineries, namely the imbalance in the consumption growth of gasoline and heavy fuel oil. In the past two years heavy fuel oil inland consumption grew by over 20% each year and diesel oil consumption by about 16% while gasoline demand rose by less than 10% per year. If foreign bunker liftings are added the imbalance is even greater. As was mentioned above, Western Europe is trying to balance its supply and demand of light and heavy oil products by exporting gasoline and importing fuel oil but the continued restriction on gasoline consumption in form of discriminatory taxes, the official encouragement to use diesel fuel instead of gasoline as road fuel and the need to substitute more and more residual fuel oil for coal make it unlikely that these two types of oil products will strike a balance in the foreseeable future under current price and refinery yield conditions. It seems likely therefore that the price of the heavy products will be raised as their share of each barrel of crude oil goes up.

What about oil in Western Europe's economy of the future? The best answer yet to this very speculative question has been supplied in a report just issued by the Energy Commission of the OEEC. The report strongly emphasizes the increasing dependence of Europe on imported fuel of all kinds until at least 1975. This trend is certainly not new. In fact, it is the main feature of Western Europe's postwar energy pattern, as compared to the prewar period. Europe started to be a net importer of energy in the thirties but by 1937 its net energy imports accounted for only 4.5% of its total energy needs of 560 million tons of coal equivalent. In 1955, imports accounted for over 20% of a total energy consumption of 730 million tons. In 1948 Europe became a net importer of coal and since then has had to bring in annually about 15.7 million more tons of coal from abroad (mainly the U.S.) than it shipped to the outside world. During the same seven years oil imports rose from 273 million barrels per year to 588 million.

Energy requirements will grow from last year's 730 million tons of coal equivalent to 820-860 million in 1960 and to 1,100-1,300 million tons by 1975, according to the commission's report. In other words, they will expand by one half to three quarters over the 1955 figure within the next 20 years, or at an annual rate of 2.1-2.9%. Accompanying Figure I suggests the growth of this demand and how it will be met. The outstanding factor in this diagram is the continuing decline of indigenous energy production relative to demand. Coal and lignite production will increase by 1%, respectively 2.5%, per annum until 1960 and after that will just maintain their output levels. Waterpower is expected to grow by 5.9% per annum until 1960 and by 3.7% thereafter. Domestic oil and natural gas production will show the sharpest increase as it will quadruple over the next 20 years but by 1975 it will still account for only 6% of the area's total energy consumption, as shown in Table V.

Altogether, indigenous production which now accounts for 80% of total energy demand will provide no more than 63% by 1975, according to the report. Atomic energy—produced mainly from imported raw materials—will come into commercial existence after 1960 but will not account for more than 8% of Europe's total energy demand by 1975, or the equivalent of 80 million tons of coal or 1.1 million b/d of crude oil. Coal imports will grow slightly to reach 50 million tons by 1975, the bulk of which will come from the United States. However, the main task in closing the growing energy gap will fall to oil imports. In the Commission's estimates of imports, oil will increase as follows over the next 20 years as shown in Table VI.

On the basis of these forecasts oil imports will rise at cumulative annual rate of 5.8% over the next five years and 5.1% over the next 20 years if the mean figures in Table VI are assumed to represent the most realistic forecast. For the shorter period coal imports will rise at a higher rate but over the long run their cumulative increase will be only 2.8%. These figures are a vivid illustration of the task assigned to oil imports in filling the European energy gap which the OEEC Commission expects to grow at a cumulative annual rate of 4.4-6.8%, depending on the assumed growth rate of the area's economy.

Will the oil producing centers of the free world be able to provide Europe with such ever-increasing quantities of imports? The report answers this question with the statement that "the oil companies with whom we had discussions assured us that in view of their present knowledge of oil reserves ample crude oil would be available to meet the maximum demands of our forecasts. They pointed out that oil is an international industry and that Europe's consumption at present only represents 15% of the whole, though this might rise to 20% by 1975. However, the oil companies qualified their affirmative answers with the warning that to meet such vastly increased requirements would involve very heavy capital expenditures and since the oil industry is largely self-financing the job could only be done if no restrictions such as price maxima would prevent the companies from maintaining an adequate level of earnings and if nothing was done "to prevent the integration of the supply of oil products to Western Europe as part of the international oil industry."

The report estimates that total new investments in Western Europe's crude oil and natural gas producing over the next 20 years would have to amount to $10 billion to reach the targets given in Table V. In the first postwar decade $3 billion was invested in this sector of the oil industry. Refining capacity which was raised from 300,000 b/d in 1945 to 2,200,000 b/d at the end of 1954 at a cost of $3.2 billion (including ancillary plants, transportation, etc.), will have to be raised by another 1,600,000 b/d to a total of 3,800,000 b/d by 1975. This would enable Europe to process all its domestic crude plus 75% of its total oil imports by 1975. The cost of this expansion would be about $2.4 billion, including replacement

TABLE V

Oil and Natural Gas Production in Europe

	1955	% of total energy demand	1960	% of total energy demand	1975	% of total energy demand	Cumulative Annual Rate of Increase from 1955 1960	1975
Crude oil (000 b/d)	180	2	350	3	700	4	14.9%	7.2%
Nat. Gas (billion cft)	133	1	266	1	532	2	14.9	7.2

Source: OEEC

TABLE VI

Oil Imports* into the OEEC Area in 1955, 1960 and 1975
(thousands barrels daily)

	1955	% of Total Energy Demand	1960	% of Total Energy Demand	1975	% of Total Energy Demand
Maximum			2,420	20	5,676	32
Mean	1,627	16	2,142	18	4,300	26
Minimum			1,864	16	2,924	20

*Excluding bunker imports for ocean-going vessels.

of obsolete plants. Transportation and distribution facilities will have to be enlarged by about 3,100,000 b/d to meet the increased consumption. This will cost $4.6 billion, bringing total investments in Western Europe's petroleum and natural gas sector to $17 billion over the next 20 years. Since the bulk of these investments have been and, under normal circumstances, will continue to be made by the oil companies themselves, including a number of non-European concerns, these expenditures will not be a burden on the European capital market.

Finally, the report discusses the effect of the increasing energy imports on the European balance of payments. Since virtually all the coal imports and a good part of the oil imports will have to be paid in dollars, this fact is of great importance in view of Europe's structural dollar deficit. This deficit is presently more than covered by U.S. unilateral defense and related expenditures in Europe but if these were to drop sharply the OEEC countries might find it difficult to close their energy gap as rapidly and fully as the Energy Commission foresees.

The OEEC report itself makes no mention of a possible dollar shortage and its effect on the level of energy imports but it does state that "the cost of imported energy is likely to rise quickly" and that it will represent an increasing proportion of all imports into Western Europe. In 1955, total energy imports, at $3.5 billion, represented about 16% of all imports.

Also, the report's estimate of the cost of future energy imports based on the admittedly unrealistic assumption that energy prices will not rise above their present levels. Actually, the Commission is convinced that both oil and coal prices will rise. On the other hand, the composite price of oil products imports is expected to drop due to the shift from high-priced to low-priced imports. On the basis of present prices, this would mean a reduction from the current average products imports price of $4.43 per barrel, f.o.b. Gulf, to $4.14 per barrel in 1960 and $3.86 in 1975. This is bound to influence the total cost of oil imports since the share of products imports (mainly fuel oils) is expected to grow relative to crude oil imports:

	1955	*1960*	*1975*
Share of products imports	7	13	25
Share of crude oil imports	93	87	75
	100	100	100

Bearing in mind the above assumptions plus the following additional ones: (1) a mean increase in oil imports, as per Table VI; (2) a cessation of European oil exports by 1960; and (3) that 25% of oil shipping costs will be incurred outside of Europe, the cost of oil imports will be shown in Table VII, over the next 20 years, on the basis of OEEC figures.

According to this table, Western Europe will spend at least $6 billion just on oil imports by 1975 of which over $4.3 billion must be paid abroad. It is not possible to predict how much of this amount will have to be paid in dollars. The oil industry of the Middle East from where the bulk of the imports will come is owned 58% by American and 42% by European companies. However, this does not provide a correct key to the future share of dollar and soft-currency oil imports since most U.S. oil companies have private arrangements with European countries under which part of their oil sales are paid in local currencies. Whether this share will be increased depends in part on the ability of European manufacturers to provide U.S. oil companies operating overseas with more of the oil-producing, processing and transporting equipment of the same quality and type than made in the U.S.

TABLE VII

Net Oil Imports into Western Europe, 1955, 1960 and 1975

	thousands of barrels daily (at 1955 prices)			million dollars		
	1955	1960	1975	1955	1960	1975
Products	101	252	1,010	220	500	1,900
Crude Oil	1,526	1,890	3,290	1,830	2,250	4,000
Total (c.i.f.)	1,627	2,142	4,300	2,050	2,750	5,900
Freight & Insurance paid in Western Europe				600	760	1,580
Total Net Foreign Disbursements				1,450	1,990	4,320

Though the OEEC report is concerned more with the traditional sources of energy than with nuclear power which will not yet be very significant by 1975 it does give an indirect indication of the estimated economic cost of nuclear energy raw material and processing and also permits a comparison with the same cost factors in the oil industry:

	Oil	*Nuclear Energy*
Landed cost of imported raw material, per barrel of oil equivalent	$3.40	$ 0.27
Total investment in processing equipment, 1955-1975.	$2.4 billion	$11.5 billion
Increase in processing capacity, 1955-75, in barrels of oil equivalent	560 million	378 million

	Oil	*Nuclear Energy*
Investment in processing equipment, 1955-75, per barrel of oil equivalent.	$4.29	$30.43

The outstanding factor in this comparison is the very low price of nuclear raw material—uranium ore—relative to crude oil and the very high unit cost of nuclear power plants relative to oil refineries. Of course, the comparability between an oil-processing plant and a power plant of any type is limited since the output of the former is used as raw material in the latter, although both are secondary energy producers and in some consumption sectors fuel oil and electricity are directly competitive.* However, the real meaning of these figures is that the development of commercial atomic energy, aside from its technical problems, is largely a matter of securing the necessary capital. Europe's atomic energy industry will need considerably more money over the next twenty years than will be invested in the processing, transporting and distribution sectors of the European oil industry. Yet, unlike in the oil industry, the possibility of self-financing does not exist and it is doubtful whether the European private capital market can furnish such gigantic sums. Thus in all probability the bulk of the investments will have to come from national and international government sources which means that commercial atomic energy in Europe will from its outset be a government-controlled and government-owned industry.

Will this extension of public control have any consequences for the still private sector of the European energy industry of which oil is the most important? For the immediate future the answer is no, but there are certainly signs that in the longer run all segments of Europe's energy industry will come under even closer national and supra-national scrutiny. The OEEC report merely confines itself to recommending increased cooperation between member countries in the field of energy, including the pooling of research and development programs, the international coordination of energy policies, the supply of capital for energy production, etc. However, the European Coal and Steel Community which already had established a common market for coal where prices, production, freight costs, etc. are under supra-national control is now embarking upon its much-publicized Euratom project which will extend this common market to atomic energy. In the view of some of the Community's top officials and other analysts of the European economic scene it would make little sense in the long run to have a common market which controls some energy resources while leaving other equally important ones free. It is therefore felt, by these officials, that once Euratom has been established, increased attention will be paid to bringing gas, oil and electricity also under some form of supra-national control. END

* A better idea might be gained by comparing investment cost per unit of output (kw) of a thermal power plant which is $160.00 or a hydro-electric plant which is $375.00 with that of a nuclear power plant which is $350.00.

Middle Distillates Sales Up

(Continued from page 47)

continues to rise. During coming months at least one major company is planning an exhibit to bring home the advantages of oil heating to European and British users.

EUROPEAN SPACE HEATING UNITS
Distillate Fuel Oil
1955

	Number of Units	Consumption ('000 of bbls.)	Consumption '000 of b/d)
Belgium & Lux.	165,000	4,639	12.7
Denmark	23,900	1,030	2.8
Finland	10,500	1,071	2.9
France	203,300	4,473	12.3
Germany (Western)	155,000	3,735	10.2
Ireland	2,930	356	1.0
Netherlands	5,100	*2,524	6.9
Sweden	N.A.	11,655	31.9
Switzerland	71,840	5,452	15.0
United Kingdom	4,980	1,431	3.9
Total above	642,550	36,366	99.6

* Burner and gas enrichment

Among the users of middle distillates the railroads have shown the most spectacular increase. As shown in Figure 1, they only accounted for about 14.7% of middle distillate sales (including diesel) during 1955, but that is a growing share, which expanded by 10% over 1954 levels. For some years a decline in the rate of growth of railway diesel engine construction has been expected, but the total this year is the highest since 1952, and is nearly twice as high as the total on order on August 1 last year.

DIESEL LOCOMOTIVE UNITS ON ORDER

Type	Aug. 1 1956	Aug. 1 1955	Aug. 1 1954	Aug. 1 1953	Aug. 1 1952
Passenger	24	47	4	62	105
Freight	62	244	96	170	744
Pass. or Ft.	657	—	8	8	68
Switch	94	176	15	244	512
	837	467	123	484	1,429

During the past 12 months, ending August 1, 1956, railroads have added 480 locomotive units to their diesel fleets, compared with 896 in the year ended August 1, 1955. The new construction underway is double that of 1955, so the increment during this year and 1957, will be correspondingly higher. This would indicate that the increase in use of diesel fuel during 1956 will exceed the 10% increase shown last year.

This rate of increase in diesel fuel use by the railroads will have to level off sometime. Complete dieselization of the railroads is expected between 1960 and 1965, and when the amount of new diesels being added begins to slow down the rate of increase in diesel fuel use can be expected to slow down also. Even so the total of diesel power is impressive. An estimate by Lubrication, a technical bulletin put out by The Texas Co., gave the number of railroad diesel units in service last year at over 25,500 which represented the imposing total of 34,500,000 horsepower. While the railroads account for most of the diesel horsepower and fuel use, there are nearly one and one-third million diesel engines in use today, as shown in Figure 4.

DIESEL ENGINES BY INDUSTRY

Industry	No. of Engines	Av. HP per Engine
Highway Transportation	155,000	140
Municipal & Utility	8,800	1250
General Industry	214,000	300
Petroleum	56,000	200
Mining	31,600	150
Construction	344,000	150
Agriculture	340,000	75
*Marine	75,000	300

Source: Diesel Power

A recent outstanding trend in the railway industry has been the use of dual fuel systems, which allow a diesel locomotive to switch from diesel fuel to lower-grade, residual-type fuels during high and medium load conditions. Since railway fuels account for up to 65% of operating costs during runs, (exclusive of salaries) use of low-cost heavier oils is of considerable importance.

Early claims made for the diesel engine stated that it could burn a wide range of inexpensive fuels. In fact it is understood one manufacturer's early fuel specification stated that "This engine will burn any liquid fuel that will flow by gravity through a ½" pipe 10 feet long." There has been considerable change in specifications since that time. With continued refinements it was found that the engines gave good performance on a clean burning distillate fuel having good ignition and handling characteristics. Consequently, most of the railroad type Diesel engines were designed to handle and burn a relatively good quality distillate fuel. Until recent years, practically all of the fuel burned in railway diese engines was made from straight run distillates. Now, because of costs, the railroads are studying ways to improve economy and utilization of power by the use of lower cost or "economy" diesel fuels.

Major lines such as the Southern Pacific and the Chesapeake & Ohio are developing and installing these new dual fuel systems, which may result in savings of as much as two cents per gallon. Southern Pacific has equipped 15 mainline freight locomotives with the system and additional locomotives are to be adapted as they are shopped.

Under the new system, the feed line from each locomotive's double-fuel tank is switched automatically from high-grade oil to low-grade oil as the throttle is advanced. High-grade fuel is needed by the locomotive when idling but as the engine works harder and gets hotter, low-grade fuels can be used.

This lowering of diesel fuel specifications has been a gradual process over the past few years. The movement has not been rapid until recently because the railroads had some experience 20 years ago that led to strict specifications for high grade fuel, and because many troubles that arise from unsatisfactory fuel cannot be detected in the early stages. By the time these troubles can be detected they are often serious and expensive to remedy.

Although tests with economy type fuels generally have shown savings, experiments have by no means been universally successful. Added maintenance costs may more than cancel out the fuel saving. One road, for example, found that a $300 savings in fuel from using a mixture of No. 2 and No. 5 fuel (saving 1½ cents per gallon over straight No. 2) caused maintenance cost to increase by an estimated $4,100. Ring wear at a little over 13,000 miles was three times what would normally be expected after 150,000 miles. Another line had an epidemic of stuck injectors using a mixture of fairly high quality economy fuels having cetane ratings from 38 to 45 and sulphur content from 0.4 to 1½ percent. A third line found that power assembly parts renewal was 8-10 times normal when using a medium quality economy fuel.

About the only consistent thing about economy fuels is their inconsistency in physical and operating characteristics. This can effect locomotive performance substantially. It is conceivable that the economy fuel program carried to its ultimate conclusion could cause the decline of the 100 percent standard diesel locomotive. While the engine parts would remain standard, substantial variation in timing and other settings may be required to successfully handle different types of fuel. END.

FIG. 1—DOMESTIC SALES OF DISTILLATE FUELS (INCLUDING DIESEL)
(Millions of Barrels)
(U. S. Bureau of Mines)

	Railroads	Vessels	Utilities	Mfg.	Heating	All Other	Total
1939	2	14	4	6	97	16	139
1940	3	13	5	7	116	17	161
1941	5	11	5	10	121	21	173
1942	6	9	6	13	122	31	187
1943	9	11	6	15	113	54	208
1944	11	-	6	17	112	65	224
1945	14	14	7	19	121	57	232
1946	18	12	11	21	140	38	240
1947	24	14	14	24	178	44	298
1948	31	15	15	30	200	50	341
1949	39	13	13	26	190	48	329
1950	49	13	13	37	221	62	395
1951	60	14	10	43	250	72	449
1952	68	17	8	43	263	80	479
1953	75	17	7	42	267	81	489
1954	77	16	6	42	305	80	526
1955	83	15	5	42	338	80	563

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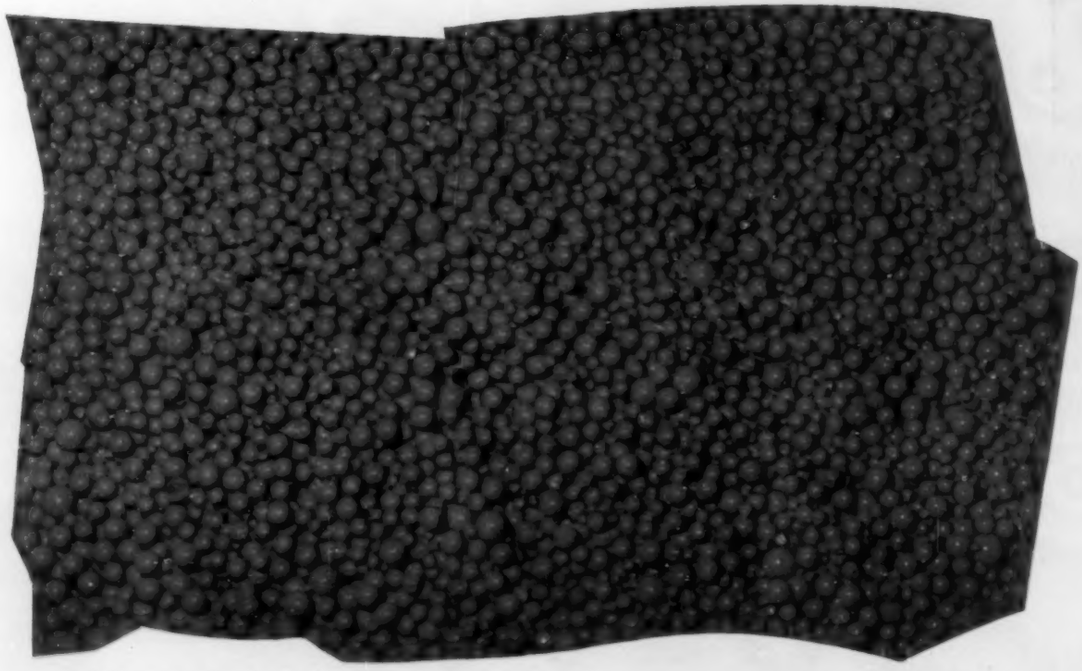

The grinding charge of a ball mill used for making paint.

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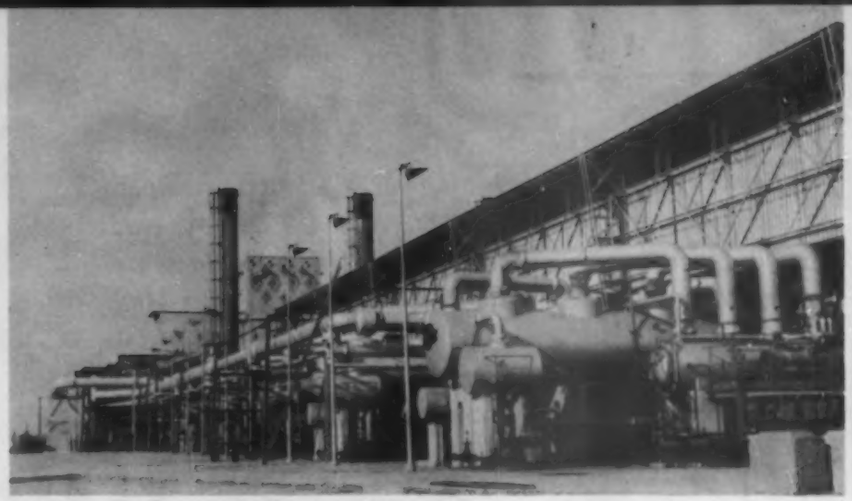
CANADA	MONTREAL	ITALY	TRIESTE	SWEDEN	GOTHENBURG
CANADA	VANCOUVER	JAPAN	KOBE	U.S.A.	NEW YORK
DENMARK	COPENHAGEN	MEXICO	MEXICO CITY	U.S.A.	SAN FRANCISCO
FRANCE	LE HAVRE	NORWAY	BERGEN	VENEZUELA	MARACAIBO

EXPANSION IN KUWAIT



Water is the most precious commodity in general use in an Arab community. In Kuwait oil reserves are being used to produce adequate quantities of potable water by distillation of sea water.

By E. Lawson Lomax

UNDER the dynamic control of its managing director, C. A. P. Southwell, Kuwait Oil Company's production has exceeded all original estimates and has shown the world's fastest growth rate. Production began in June 1946, and for the latter half of that year it averaged about 32,217 b/d. In 1947 this average rose to 44,460 b/d and it has risen each year since then. The average for 1955 was 1,091,763 b/d with a total production of over 53 million tons in that year.

The number of producing wells at the end of 1955 was 185 compared with 8 at the end of 1946. The large increase in production has entailed large increases as well in operating facilities, tankage, housing accommodation for staff or all grades and loading facilities.

Initially, the sole producing area was the Burgan Field which covers over 135 square miles, the major axis of which runs north and south. The producing horizons are sand and sandstone, at depths varying between 4,000 feet and 5,000 feet and underlain with salt water. The average gravity of the crude oil produced is 0.868 (31.5° API).

In the latter half of 1951, exploration drilling was begun in the Magwa Ahmadi area, north of the Burgan field. This has now been developed as a producing field with 51 wells at the end of 1955.

The latest development in Kuwait is the recent strike of oil at Raudhatain Well No. 1, which was spudded in on Sept. 12, 1954. The location of this site followed a program of geological and geophysical research in north Kuwait which indicated the existence of depth of geological structure favorable for the accumulation of petroleum. This location is situated some 60 miles north of the operations at Magwa/Ahmadi and before drilling could be commenced a considerable amount of preliminary work was necessary. One of these preparations involved the skidding of a heavy National Type 125 Draw-Works and 136 foot derrick over 99 miles of desert. In addition a camp had to be built for the accommodation of the personnel employed on the job, as well as arrangements being made for the supply of food, fuel, water, etc.

The drilling target was a band of oil sands which was assumed to be present at a depth of about 9,000 feet. It is understood that considerable and separate production zones were encountered during the drilling operations which were continued down to a depth of 10,301 feet. At this depth, casing was set and production tests were carried out, which were completed at the end of November 1955. These tests are said to have shown the existence of remarkable oil accumulations, but the actual extent and commercial value of them can only be proved by further drilling.

An offset well, Raudhatain No. 2, was spudded and is now being tested. The heavy rig has been moved to Sabriya No. 1, about 10 miles southeast, for another exploratory test. Another wildcat, is drilling at Bahra, 12 miles southeast of Sabriya. It is near the first, and only, dry hole in Kuwait, drilled in 1937. Recent reports on Raudhatain No. 2 indicate it may be less productive than No. 1.

J. W. Platt, managing director of the Shell Group, recently stated that production of crude oil from the Middle East fields is estimated to reach a total of 400 million tons (about 8,000,000 b/d) by 1965.

Judging by last year's production and recent discoveries it would appear that Kuwait will be able to maintain its standing in the future among the large producers.

A large amount of new work is being carried out, covering both increased production and handling facilities, as well as the provisions of amenities of all kinds for indigenous and imported personnel.

Although Kuwait possesses the largest oil loading terminal in the world, with its eight berths capable of being simultaneously in use on its gigantic pier, and also its five submarine berths, this loading station is now working at almost complete saturation rate and a hold-up of only a few days, due to adverse weather affecting loading conditions, is liable to affect loading times of vessels for some weeks ahead.

If production is to be speeded up to cope with rising demands during the coming decade, one of the obvious necessities will be increased loading facilities. In 1955, production from Kuwait was more than one-third of total production in the Middle East. If that proportion is maintained, Kuwait's share of the production in 1965 (if Mr. Platt's estimate is accepted) will be of the order of 135 million tons (2,700,000 b/d). This would necessitate more than duplication of the present loading facilities at Mina-al-Ahmadi, or at some other location nearby.

This increase in production will not necessarily mean an equivalent increase in the number of tankers loaded, however, as the average weight of oil moved per tanker cargo is increasing all the time. In 1951 the average cargo weight was under 16,000 tons, but this had risen by 1955 to over 19,000 tons as the number of larger ships increased and the smaller ones diminished.

The Kuwait Oil Company has had a refinery of a capacity of 30,000 b/d running for some time, its purpose being to supply local light fuel requirements and also bunkers and diesel oils for tankers. This capacity will be increased to 190,000 b/d by the installation of two further atmospheric crude oil distillation units of 80,000 b/d capacity each.

These units will each have a gasoline stabilizing unit, and will take off approximately 22% of distillate. The gasoline will have a F.B.P. of 160-180°C. The purpose of these units is to increase the production of middle distillates, marine diesel and furnace fuel oils, including tanker bunkers. This also fits in with the change in Eastern Hemisphere refining for the production of larger quantities of heavy fuel oils from

The two new units are being designed and procured by E. B. Badger and Sons (Gt. Britain) Ltd., who built the existing refinery. Construction will be carried out by the Bechtel International Corp. of U.S.A. in conjunction with George Wimpey & Co. Ltd. of Great Britain. Bechtel and Wimpey will also carry out the erection of the necessary auxiliary equipment, for increasing the power, steam and water facilities, separating plants, distribution lines, pumps, etc. Further crude and products storage tanks are also to be erected. The asphalt used for the large road construction program in Kuwait has all been produced in a special asphalt plant attached to the refinery at Mina-al-Ahmadi.

Work on this project has begun on a site adjoining the existing refinery at Mina-al-Ahmadi. Completion of the whole scheme is scheduled for the end of 1957. END

Results of a three-year testing period show that evaporation losses are reduced up to 90% on sweet and sour crude oil, and up to 60% on refined petroleum products protected by phenolic plastic "Microballoon" spheres. Methods of installation, gauging, prevention of foam loss, shipping precautions, effect on vapor combustibility and a probable cost analysis are included in this report.

Evaporation Control by Microballoon Spheres

By C. E. Grief*

An estimated two to four percent of the petroleum products in storage throughout the world disappear into thin air via the evaporation route. This loss is being partially controlled through the use of pressure type storage, floating roof tanks and other vapor conservation devices. Plastic "Microballoon"[1] spheres, forming a foam-like blanket on stored crude and products, have been tested during the past three years as a supplement to other forms of evaporation control. The spheres now are considered applicable for use in storage tanks, which for economic reasons, cannot utilize the other vapor conservation techniques available.

[1] *Trade mark of The Standard Oil Co. (Ohio).*

Fig. 1. Simplest and most effective for installation of "Microballoon" spheres is by the preferred aspirator method.

Plastic "Microballoon" spheres were developed in the laboratories of The Standard Oil Co. (Ohio), and are currently being produced in the United States under license by Union Carbide and Carbon Corp. and the Colton Chemical Co. Their general characteristics vary considerably according to size, density and composition, and they can be made from phenolic or urea plastic resins. Physical properties of the two types are as follows:

	Phenolic Type	*Urea Type*
Particle density, g./ml.	0.32	0.29
Average diameter, Microns	16	36
Diameter, Microns	2-60	5-150
Percent sinkers	less than 5	less than 5

"Microballoon" phenolic spheres are marketed in multiwalled polyethylene linco paper bags containing 18 pounds per bag. Conventional forms of transportation are employed and no special handling procedures are required other than those ordinarily observed to insure undamaged delivery. It is important, however, to keep the spheres dry, both in transit and in storage, for efficiency of the product in use depends considerably on its installation in a water free state.

The spheres may be installed simply by dumping the contents of the required number of bags onto the surface of the oil. This method, however, causes a heavy foam layer in the area of dumping. It also places the spheres in danger of being contaminated by water condensation in the tank. Agitators or a stream of oil should be employed when using dry dumping methods to help facilitate even distribution.

Mixing the spheres with the petroleum product in question and then dumping is another method. The prior mixing causes a liquid slurry to be formed, and is more advantageous than dry dumping because of the fact that the mixture will spread out more quickly and evenly, and the oil coated spheres are less subject to damage from water condensation. Slurrys may be poured into the top of the tank or pumped through the normal input line.

*Plastics department, Union Carbide International Company, New York.

The most effective way to install the spheres is to pump them in with crude or products. An aspirator, such as the one normally used to mix dry chemicals with water in foam fire fighting systems may be used. Oil is pumped through the aspirator, and the mixture of "Microballoon" spheres and oil is piped to the regular tank inlet or conveyed by hose to the top of the tank. If a swing line is used for installation, care should be taken to make sure the line is placed a few feet below the surface of the oil, yet high enough so as not to trap the spheres in the bs and w which may be present in crude.

If a tank has been emptied for cleaning and is water dry prior to the insertion of the spheres, they may be dry dumped in the tank prior to filling.

The method of gauging tanks covered with the layer of "Microballoon" spheres is almost the same as for present practice, except for the addition of a gauge well on the gauge line. A gauge which is simple to fabricate and has already been used effectively is shown in Fig. 1. It consists of a 1-inch copper tube, eight inches long, on which is mounted a copper float. The gauge line is lowered into the tank and the plumb bob penetrates the foam. Then the whole apparatus continues on down into the crude oil until the apparatus floats. The spheres are eliminated from the surface of the oil and accurate gaugings are then possible. Tank temperature and water and sediment samples are unaffected by the presence of any spheres in the sample. They simply float to the surface of the sample and allow for clear and accurate readings.

Care is required to see that the layer of spheres is not lost from pumping a tank too low. With sufficient stress on the low level cutoff point by operators, the loss of "Microballoon" spheres should be kept to a minimum. In tanks equipped with swing lines, the shut off point should be set above the swing line height. Vortex movements,

while reduced considerably by the sphere layer, should also be considered in setting shut off levels. Another solution to the problem is the installation of automatic shut off valves where available. Loss of the spheres through pipelines and pumping equipment is to be guarded against only because of the loss of the layer and its effectiveness. The spheres are non-abrading and will not harm any pumping equipment. Special precautions must be followed in the case of refined products.

Explosive vapors in oil and gasoline tanks are normally in a dangerous state 25-30% of the time. When being emptied, a more dangerous condition exists than when tanks are being filled. The "Microballoon" layer has not had any effect on this condition. It does not increase the fire hazard, and thus may be said to be a neutral element.

Evaporation control has been found to be equally effective regardless of the type of oil in storage. Further, vapor analyses have indicated that the use of the spheres may aid in the lessening of the corrosion rate in sour crude oil tanks. Generally, working crude storage tanks have shown reductions of 60 to 85% of evaporation loss immediately upon use, with improvement in savings after the first few weeks of installation. Static crude storage tanks have consistently and immediately shown from 90 to 95% effectiveness.

Data substantiating these figures is available from various tests. Shell Oil Co. of Canada, in a test at its Shellburn-Vancouver refinery, showed that on a 55,000 bbl. working tank with a ½-inch foam layer, a reduction in evaporation losses of 60% after one week and 75% after three months was obtained. Imperial Oil Ltd. found that losses from a 150,000-bbl. static tank at its Sarnia refinery were reduced 90% by a ½-inch layer during a 4-month period. Esso Standard Oil Co. at a 42,000-bbl. tank at Bayway, New Jersey, achieved a 95% reduction in losses during a 71-day static test with the ½-inch layer. Sohio had 87% control with a 1-inch layer in a 25,000-bbl. static tank during ten months, and 86% reduction on the same tank during two working months.

Refined products laboratory, pilot scale and field tests have shown that "Microballoon" spheres have reduced evaporation losses 50% or more on refined petroleum products, both working and static. The thickness in layer has some effect on the evaporation rate. A 1-inch layer saved 50% as stated above, while a 2-inch layer showed 60% reductions in evaporation losses. Results of some tests are noted as follows: Union Carbide laboratories conducted 55-gal. drum tests with the following results: Motor gasoline evaporated at 10.5 gal. per 100 square feet per day without the spheres, at 5.7 gals. with the "Microballoon" layer, a reduction of 46% in losses. Tractor fuel losses dropped from 5.1 to 2.6 gals., a reduction of 49%; jet aviation fuel from 5.4 gal. to 1.9 gal., a reduction of 64%. Foam thickness was one inch in half filled tanks. Sohio set up a motor gasoline test on working tanks 11 ft. in diameter by 25 ft. high. Evaporation occurred at 144-147 gals. per 1,000 sq. ft./day for a period of 16 days on both the test and control tanks. In a 46-day period that followed, the control tank (without the sphere layer) continued losing at a 130-gal. rate while the sphere protected tank lost at a 63-gal. rate, a loss reduction of 52%.

In an additional 26-day period, while the control tank reverted to a 147 gal./day loss, a 2-inch layer further reduced losses 52 gal./day, or a control factor of 63%. In this latter test a small amount of surfactant was incorporated with the "Microballoon" spheres—2% by weight of Duponol OS—to aid in accelerating the formation of a more tightly packed and fluid layer.

Because of the closeness of refined petroleum products to their end use, it is important to see that none of the spheres reaches the final consumer. The spheres, if allowed to enter combustion chambers of vehicles, will freeze the engines. Shut off points, low level controls, and extreme care must be used. A filter must also be used at the outlet point to absorb any particles which may be in the products. Tests of the spheres in the United States have been on high purity products, and it is imperative that careful testing be conducted on the various grades of petroleum products prior to general use. While small quantities of benzol (benzene) are not known to affect the spheres, quantities of alcohol in refined products will affect the spheres in the same manner as water.

Water, in laboratory tests, caused up to 25% sinkers in the foam layers. This condition, while brought down to 18-20% by improvement of the product, has not been eliminated. Extreme care should be used to see that the spheres, when used on gasoline or crude oil, be kept in a water dry state, or slurried with oil prior to exposure to water. When mixed and coated with oil or petroleum products, the spheres are more resistant to water attacks, and in fact the sinker rate is the same as the product specification, i.e., less than 5%.

Based on the Standard Oil Co. (Ohio) tests on motor gasoline, the following economic calculations were deduced:

Conditions

Tank size—11' x 25'
Service—active bulk station
Ohio area, September to December
Throughput, about 800,000 gal./year
Regular motor gasoline

Evaporation Loss

140 gal./1,000 sq. ft./day. Loss rate measured corresponds to 4,550 gal./year for 11' diam. tank,
or at 17¢/gal. (tax paid) = $775/year.

Savings

1" layer saved 50% or $387/year.
2" layer saved 60% or $465/year.

Estimated Installation Costs

	1" layer	2" layer
Microballoon particles	$60.00	$120.00
Accessories	30.00	30.00
Tank cleaning	60.00	60.00
Labor	60.00	60.00
	$210.00	$270.00

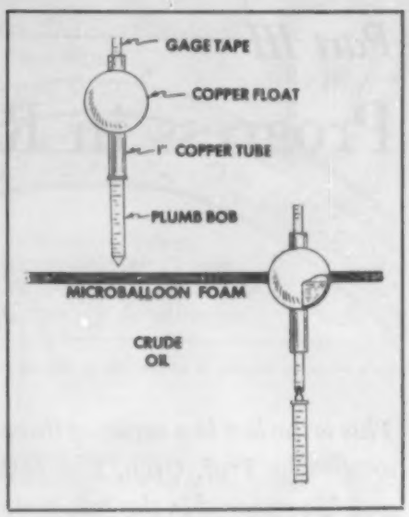


Fig. 2. A workable gauge for the measurement of oil tanks when covered with the "Microballoon" sphere layer.

Cost Recovery Time

1" layer $\frac{\$210}{\$387} = 0.54$ year or 6.5 months

2" layer $\frac{\$270}{\$465} = 0.58$ year or 7.0 months

The figures presented here are in United States dollars, at standard United States labor and equipment costs.

SUMMARY: "Microballoon" spheres are not intended to replace other types of evaporation control devices. In the fields where they are usable, however, they adequately perform the job for which they were designed. Evaporation loss reductions frequently save sufficient product to recover costs within the period of one year. The effective life of the spheres has not yet been established, however, in some installations they have been in use two years and longer. Also, if partial loss of the sphere layer occurs additional quantities of the spheres may be added as needed to maintain desired foam thicknesses. Crude oil (sweet and sour) normally are controlled by ½-inch layers on static tanks and 1-inch layers on working tanks. Refined products show greatest savings when 2-inch layers are used although the 1-inch layers are quite effective. Prior to general use in any area, tests should be made to determine the spheres effectiveness in any particular location. Weather conditions, purity of product, condition of tanks, and low level cutoff controls may all affect the spheres over a period of time.

The general observations and results would suggest that the "Microballoon" sphere layer technique is suitable for use on all sizes of crude oil tanks, and for the many refined product cone roof tanks in use around secondary terminals. It provides considerable evaporation control at a fairly low and rapidly recoverable cost, and seems attractive for those locations where capital expenditure for the conventional vapor conservation devices has not been sufficiently attractive. END

Part III

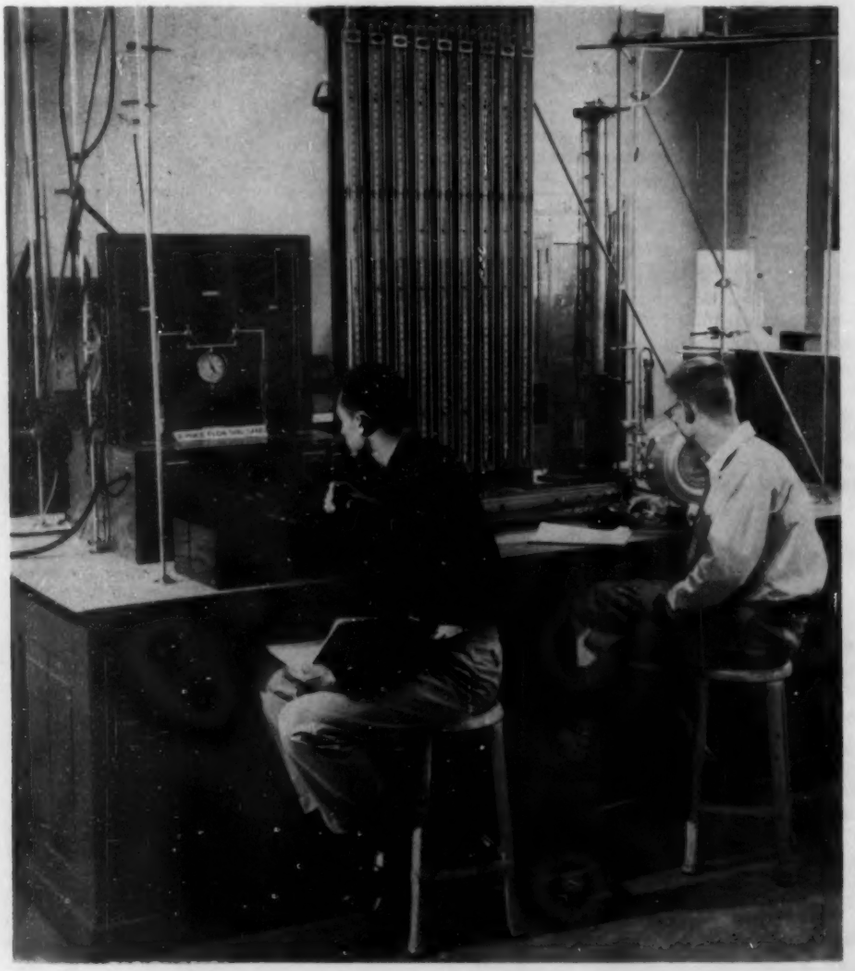
Progress in RESERVOIR TECHNOLOGY

By Lester C. Uren,
Emeritus Professor of Petroleum Engineering, University of California

This is the last in a series of three articles by Prof. Uren. The first article appeared in the July issue of WORLD PETROLEUM and the second appeared in September.

THE two preceding articles of this series have suggested that drainage of petroleum from its reservoir rocks must involve many complex variables. Among these are the physical properties of the oil (viscosity, density, surface tension) and the lithologic character of the reservoir rock (permeability; porosity; size, shape and continuity of the pore openings, character of mineral surfaces). In addition to these factors, which relate primarily to the nature of the reservoir rock and its contained fluids, we must also give consideration to the expulsive and retentive forces operative.

Fig. 1. Apparatus for studying two-phase flow through a sand column, University of California Petroleum laboratory.



It is apparent that at least three natural forces latent within oil and gas reservoirs, may be brought to bear in forcing the fluids through the pore spaces of the reservoir rock into well outlets. These are gas pressure, edgewater pressure and gravity. It is also evident that certain natural forces resist expulsion of fluids from the reservoir rock, particularly the capillary attraction exerted by the rock pores for the contained fluids, the adhesive attraction existing between the reservoir fluids and the mineral surfaces surrounding the pore spaces, and the pore friction which opposes all fluid movement. It is clear that energy must be consumed in moving fluids through the restricted pore spaces of the reservoir rock, and research studies have shown that the energy consumed is proportional in some degree to the rate of flow. Also, it can be demonstrated that the rate of flow is determined by the existing pressure differential, the length (drainage radius) and cross-section (porosity) of the flow channel, and the rock permeability.

Many research projects have had the objective of measuring the pressure loss in flow of liquids and gases through the pore spaces of unconsolidated sand or core samples of petroleum reservoir rocks. By analysis of the results, efforts have been made to formulate all of the variables involved with the object of developing an all-inclusive formula that might be used in calculating such pressure losses under all conditions. In most of these studies, it has been assumed that the reservoir rock is uniform in porosity and permeability or has a certain average porosity or permeability.

The expulsive forces. The first attempt to appraise and classify the natural forces responsible for expulsion of petroleum from its reservoir rocks on a scientific basis is to be found in a book published in 1928, entitled "Analytical Principles of the Production of Oil, Gas, and Water from Wells", by S. C. Herold.[6] In this book, the Author conceives the reservoir fluids to move through the pore spaces of the reservoir rock in response to certain"controls". Thus, he speaks of reservoirs under "volumetric control", "hydraulic control", or "capillary control". Volumetric control reservoirs are supposed to maintain a constant volume and expulsion of the reservoir fluids is accomplished

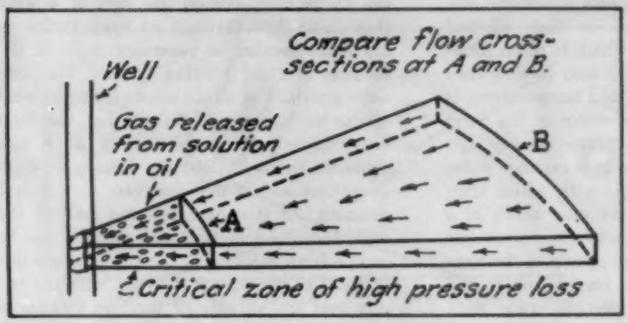


Fig. 2. Segment of reservoir rock about a well illustrating radial drainage.

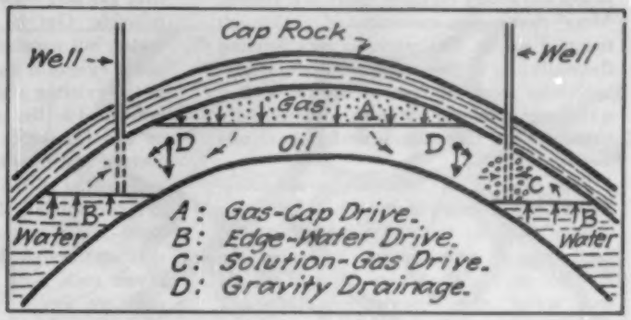


Fig. 6. Sketch demonstrating manner of application of natural expulsive forces in oil and gas reservoir.

by the expansive effects of natural gas. Hydraulic control reservoirs diminish in volume as fluids are produced, and expulsion of oil and gas is accomplished as a result of invasion of the reservoir by edge-water under pressure. In capillary control reservoirs, the fluids are responsive primarily to capillary forces which determine a maximum drainage radius for each well. Later investigations have cast considerable doubt on the validity of the concept of capillary control, though it is recognized that capillary forces play an important role in all drainage systems.

Today, we know that many oil reservoirs are producing under the influence of high-pressure edge-waters ("water drive"); while others produce by expansion of large bodies of free gas under pressure, trapped in the crest of the structure ("gas-cap drive"), or by the expulsive effects of gas in solution in the oil, the gas being released from solution and expanded in the reservoir as pressure is reduced ("solution-gas drive"). It is recognized that gravitational force is always operative and may function alone or in combination with either of the other expulsive forces.[6]

In a broad classification, we can classify all oil and gas reservoirs into two groups: (1) Reservoirs in which edge-water enters and replaces the oil and gas as rapidly as they are produced, thus maintaining constant or moderately declining reservoir pressure; and (2) Reservoirs in which the edgewater is either stationary or else does not enter rapidly enough to keep pace with depletion, which is accomplished primarily by gas expansion. Under this classification, we may conceive of any or all of the expulsive forces being simultaneously operative, through one or another may be dominant during different periods in the life of the reservoir.[17]

Energy stored by nature in oil reservoirs is dissipated in the expulsion of fluids from the reservoir rock and the expulsive forces gradually come into equilibrium with the forces that resist expulsion. However, the energy latent in high-pressure edge-water may, under some conditions, be restored and sustained by seasonal accumulation of meteoric ground water in communicating outcropping strata. Modern systems of oil production seek to achieve maximum efficiency in utilization of the natural reservoir energy by regulating the rate of production and controlling the differential pressure between the reservoir and the well outlets. Reservoir energy may be artificially restored by injection of water or compressed gas into the reservoir.

Natural forces resisting expulsion of fluids from reservoir rocks. The forces opposing drainage of petroleum from its reservoir rocks are primarily the expression of intermolecular attraction between the reservoir fluids and the surrounding mineral mineral surfaces. A stationary film of liquid (oil or water) adheres to all exposed mineral surfaces and will not be removed by ordinary methods of drainage. While this film is thin, the mineral surfaces exposed are very large, and an important percentage of the original oil content of the reservoir may be so retained after all normal drainage has ceased. If the mineral surfaces are coated with drusy secondary mineral deposits, thicker films are retained than if the surfaces are glassy. Closely compacted angular mineral fragments will retain still thicker films in acute re-entrant angles and in constriction in flow channels between pores.[17]

The reservoir pore spaces are of capillary size and exert capillary attraction on the contained fluids. Capillarity has an important influence in determining whether or not fluids may move from and through the pore spaces of the reservoir rock.[7] Rock pores must be smaller than a certain size to exert capillary attraction. For water, the maximum critical size is about 0.5 mm in diameter for an opening of tubular form. Super capillary openings of larger size, exert little or no capillary attraction and are not a factor in drainage of reservoir rocks insofar as capillarity is concerned, though they are important in determining the permeability and storage capacity of the reservoir. Fluids within them respond to the ordinary laws of hydraulics. Subcapillary openings, generally less than 0.002 mm in diameter, exert so great an attraction for the contained fluids that they cannot be drained from the rock by any force that can be brought to bear in practical oil-field exploitation procedures.

The selective action of capillarity in drawing water rather than oil into the smaller capillary spaces has been discussed in the second article of this series. Water, so segregated from the oil, is also retained more effectively than oil in the smaller recesses of the reservoir rock. Capillary pressure studies have demonstrated that the "capillary drag" resisting movement of fluids through the pore spaces of the reservoir rock is a powerful force that must be reckoned with in any drainage study. Experiments have also indicated that a zone of capillary retention in the bottom of every oil-bearing stratum is likely to remain saturated with oil after all drainage ceases.

"Oil-wet" or "water-wet"? Most of the early drainage studies were conducted in laboratory apparatus designed to conform as nearly as possible with actual reservoir conditions, using sandstone cores or well-compacted unconsolidated sand to represent the reservoir rock. The pore spaces were saturated with oil and the core or sand was carefully dried to remove all moisture, so that the mineral surfaces became oil-wet. Later, more careful inspection of formation samples disclosed that they invariably contained some connate water and that the mineral surfaces in the smaller recesses of the reservoir rock were, in many cases, water-wet rather than oil-wet. The oil is usually concentrated in the larger, free-draining pore spaces, while the water is securely retained in the smaller pore spaces by capillary force. This explains why a reservoir rock containing 20% or more of connate water may yield oil with little or no water to the penetrating wells.

Research indicates that the mechanism of drainage of oil through water-wet capillary spaces is quite different from that in a system where the mineral surfaces surrounding the capillary spaces are oil-wet. Because of this, results obtained in earlier experiments using oil-wet media, have been difficult to reconcile with results obtained in later experiments in which water-wet sands and sandstones have been used. In water-wet media, if oil moves through the capillary spaces, it is separated from the mineral surfaces by stationary water films. Capillary and adhesive effects between the oil and the mineral surfaces are minimized. If, on the other hand, the mineral surfaces are oil-wet, a stationary film of oil will be retained on all mineral surfaces after all drainage ceases. Capillary effects will result in retention of additional oil. Because of cohesion between the moving and ad-

jacent stationary oil films, there is a viscous "drag" that resists movement of oil through the pore spaces. The reservoir rock forming the walls of a well will preferentially transmit water from the reservoir to the well if water-wet, while oil will be preferentially transmitted if the mineral surfaces are oil-wet.

The concept of relative permeability. When two or more immisicible fluids are flowing together through a reservoir rock, each fluid in some degree influences the flow behavior of the others. Thus, if oil, gas and water are flowing simultaneously through a reservoir, part of the pore space will be occupied by water, part by oil, and part by gas. The portion occupied by water and presumably water-wet, will be more permeable to water than to oil; and the portion occupied by oil will be more permeable to oil than to water. Gas may displace both oil and water and thus reduce overall liquid permeability. These effects are measured in terms of "relative permeability", which expresses percentage-wise or as a ratio, the relative rates or flow of the fluids present for a given ratio of fluids in the pore spaces. The ratio of permeability to gas divided by the permeability to oil (K_g/K_o) has come to be recognized as an important factor in many drainage calculations.[11]

From relative permeability studies performed under laboratory conditions, it appears that there is an irreducible minimum of water and oil content that must inevitably remain in the reservoir for any given conditions. Thus, the percentage of water remaining in the pore spaces of a sand or sandstone may seldom be reduced below about 10% of the pore space, no matter how much oil or gas may flow through the remaining pore space. Similarly, water or gas flowing through a part of the pore space will inevitably leave some of the oil content of the sand unrecoverable.

Multiphase flow through porous media. In earlier years, many laboratory drainage studies were conducted with oil alone filling the pores of a sand body used to represent the reservoir rock.[8] Later investigations have shown that a single-phase system is unrealistic, for there are usually at least two and often three separate fluids moving simultaneously through the reservoir rock and they mutually influence each other. The fluids involved, of course, are oil, natural gas and water. Oil and water are immiscible. Gas is soluble in both oil and water, but surplus gas which is often present in excess of that which may be dissolved at the existing pressure and temperature, is entrained in the oil and water in the form of small bubbles which are readily deformed and thus behave in a manner quite unlike that of the liquids with which they are surrounded. Thus, we may think of a three-phase system of oil, water and gas moving through the pore spaces of the reservoir rock, each phase responding to the drainage forces in a different way; each phase maintaining its separate identity, yet each influencing the behavior of the others.[3]

Steady flow vs. unsteady flow. Experience indicates that the flow of fluids from producing oil and gas wells is often quite variable in character. Gas invariably accompanies the oil, but some of it is "free", some in solution in the oil, and the gas-oil ratio may vary widely during different time intervals. Water also accompanies the oil and gas in many cases, and the percentage of water in the liquid produced by a well may vary widely at different times. During a certain stage of declining production, wells often "flow by heads", flows of oil alternating with flows of gas. This effect is apparently responsive to the effects of large bodies of free gas accumulating in the oil-drained spaces of the reservoir rock about the wells and periodically taking possession of the drainage channels to the exclusion of oil. The percentage of free gas in the fluid in motion through the reservoir rock increases as the fluids approach the low-pressure areas about the wells, so that the ratio of gas to oil varies greatly in different parts of the reservoir. It is apparent that steady-flow experimental data, obtained with a single-phase fluid medium, have little meaning in practical drainage operations, and that we are always concerned with a multiphase system under unsteady-flow conditions.

Radial characteristics of flow from petroleum reservoirs into wells. Drainage of fluids from oil and gas reservoirs into wells theoretically requires that the fluids move along radial lines, converging upon the wells as centers. This condition imposes flow characteristics that differ markedly from those exhibited by fluid flow through a cylindrical pipe, conduit or channel. As the fluids converge on the wall of a well, they must flow through an ever diminishing cross-section of reservoir rock. If the volume of fluid moving toward the well were constant at all distances from the wall of the well, it would follow that the fluid must move ever more rapidly as it approaches the well. But the volume of fluid in motion within the reservoir rock is not constant. As it approaches the wall of the well, reduction of pressure permits gas to escape from solution in the oil; the free gas expands as pressure is reduced, with the result that the volume of fluid in motion is much greater near the wall of the well than at points remote from the well. This operates to accentuate still further the flow velocity in the vicinity of the wells.

Experiments have shown that the pressure loss per unit of distance traveled in moving fluids through the reservoir rock is directly proportional to the rate of flow. In one series of tests, conducted in apparatus designed to simulate reservoir conditions about a high-pressure flowing well, a crude petroleum saturated with dissolved gas under a pressure of 1,000 psi, lost half of its pressure in moving through the reservoir sand within 3½ feet of the wall of a 6 inch well. It was determined that the fluids were moving 250 times as fast at the wall of the well as at a distance of only 2½ feet from the wall of the well.

Pressure and energy gradients within the reservoir rock. From such considerations, one may conceive of a pressure gradient within the reservoir rock throughout the drainage area of a well, and it becomes apparent that at points remote from the well, the pressure loss per unit of distance traversed by the reservoir fluids is very small in comparison with unit losses near the wall of the well. A well may drain fluids over a radius of hundreds of feet, but most of the pressure loss occurs within a few feet of the wall of the well.

The rate at which energy is consumed in moving fluids through the reservoir is also of interest, and if we conceive of an energy gradient within the drainage radius of a well, it can be shown that the rate of energy consumption per linear foot of travel through the reservoir rock increases rapidly as the wall of the well is approached. At points remote from the well, the energy loss is almost negligible.

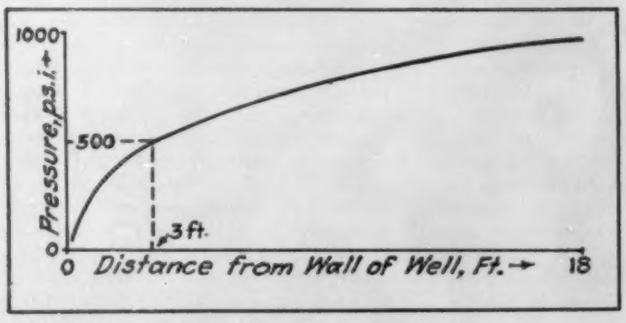


Fig. 3. Curve illustrating form of typical pressure gradient.

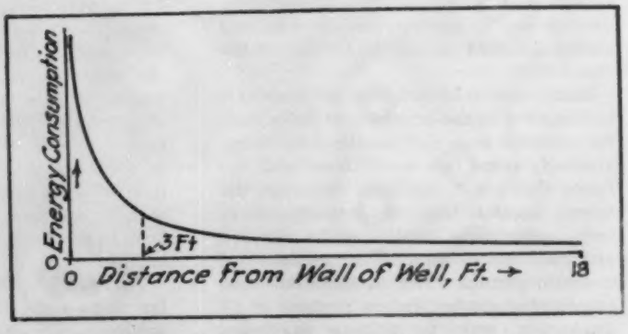


Fig. 4. Curve illustrating form of typical energy gradient.

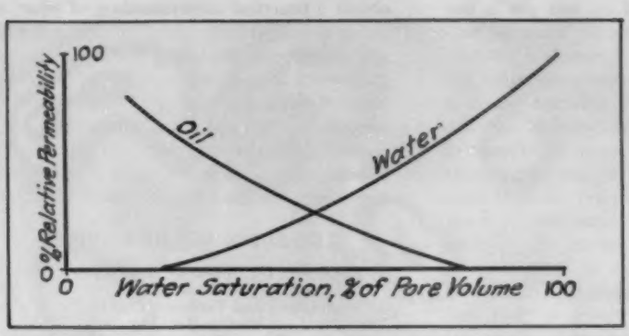


Fig. 5. Graphs showing influence of connate water on relative permeability to oil and water.

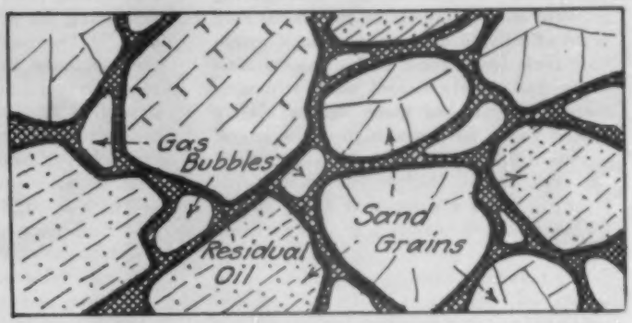


Fig. 7. Sketch illustrating retention of oil films and gas bubbles between reservoir sand grains.

We may influence the form of the pressure and energy gradients to some extent by imposing back-pressure on the well outlet, thus restricting release of dissolved gas from the oil, the expansion of free gas, and the rate of flow of fluids through the critical zone of high pressure loss within the reservoir rock immediately surrounding the well. More efficient use of gas energy in oil expulsion may thus be realized. We may also produce oil with less pressure loss and with lower gas energy consumption by drilling wells of larger diameter through the reservoir rock.

Mathematical formulae for calculating flow of fluids through reservoir rocks. Many research projects have had as their objective the development of a mathematical formula by means of which one could calculate the rate of flow of a liquid through the pore spaces of a reservoir rock under a given pressure differential.[1] It is at once apparent that many variables are involved in such a computation and that the development of an all-inclusive formula expressing the relationship existing between them presents a difficult and complex problem.

One has to go back into the early literature of fluid mechanics to find the basic data from which our present knowledge of fluid flow through porous media was developed. As early as 1856, Henry D'Arcy, a French physicist, studied the flow of water through filter beds and proposed a formula which bears his name. As noted in the first article of this series, this formula provided the basis for a method of expressing the permeability of reservoir rocks, that was adopted by an American Petroleum Institute committee in establishing the darcy unit of permeability.

In 1897, King and Slichter, of the U.S. Geological Survey, published the results of an investigation of the motion of ground waters through sands and soils, in which they offered an empirical equation with the aid of which one may compute the rate of flow of water through a sand column under a given pressure differential.[10] More recently (1933), Francher, Lewis and Barnes,* reporting results of researches conducted at Pennsylvania State College, have demonstrated application of the Poiseuille and Fanning equations—well known to students of fluid mechanics—to movement of fluids through sandstones. Muskat and his associates in the Gulf Research Corporation have published the results of extensive experimental and analytical studies of flow through porous media: best recorded in Muskat's classic monograph, "Physical Principles of Oil Production", published in 1949.[13]

While these flow formulae are of academic interest, it must be admitted that they are of doubtful value when we try to apply them to actual field reservoirs. Instances may be cited where this or that formula is seemingly substantiated by field observations, but in other cases the same formula may produce wide discrepancies. It must always be kept in mind that nature's methods of forming sedimentary strata result in a heterogeneous assortment of mineral particles of widely varying shapes and sizes, with varying degrees of compaction and secondary cementation, and that the shape and size of the pore spaces must necessarily be highly erratic. To assume any degree of uniformity in these matters is unrealistic and conclusions based on such assumptions are of doubtful validity. Because of the wide variation in reservoir conditions and the complexity of the factors influencing fluid movement through the restricted pore spaces, we cannot apply any mathematical relationship with confidence.

Reservoir performance. The forces resisting expulsion of crude petroleum from its reservoir rocks are so effective that no method of field exploitation yet devised is capable of completely neutralizing them. Much of the oil actually present in the reservoir rocks is unrecoverable by any method of field exploitation now known, and the percentage recovery that we are able to attain is determined by the efficiency with which we apply the natural expulsive forces and such supplementary aids as may be applied to release oil held in the reservoir rock by adhesion, capillarity and pore friction.

Many factors influence the percentage recovery attainable.[10] Reservoir conditions are of prime importance, particularly the character and magnitude of the expulsive forces operative, and the permeability of the reservoir rock and physical properties of the oil. "Water-drive" reservoirs generally perform more efficiently than "gas-drive" reservoirs. Where natural gas furnishes most of the expulsive energy, the volume of gas and the reservoir pressure will be an index of the amount of energy available. Gas in solution in the oil is more effective than free gas trapped in the structure. Gravitational forces, always operative, though slow acting, may be highly efficient, especially in steep-dipping formations.[12]

The manner in which a field is exploited will have an important influence upon the efficiency with which the recoverable oil may be drained. The field development program must be planned to realize maximum efficiency in application of the expulsive forces. Where edge-water is furnishing the expulsive energy, its rate of invasion of the oil-saturated portion of the reservoir should be so controlled that water does not by-pass and surround bodies of oil-saturated reservoir rock. If gas energy is the primary expulsive force operative, production methods should be employed which will result in minimum slippage of gas through the oil in the reservoir rock. Gas should be kept in solution in the oil as far as possible. Gas trapped in the crest of the structure should be retained there as long as possible.

The rate at which the wells are allowed to produce will generally influence recovery efficiency, and it appears that there is a certain maximum efficient rate of production (the "M.E.R.") which should not be exceeded. Production in excess of the M.E.R. encourages high gas-oil ratios and promotes "fingering" of edge-water around the less permeable oil-bearing portions of the reservoir. Back-pressuring wells restricts rapid expansion of gas in the critical zones surrounding the wells, which results in high rates of flow and excessive pressure loss.

The distance apart at which wells are spaced has an influence upon recovery efficiency, particularly where gas energy is furnishing the expulsive force. The greater the distance that oil must be moved through the reservoir rock to find a well outlet, the greater will be the amount of energy consumed in producing it. However, this consideration should be weighed against the knowledge that comparatively little energy is consumed in moving oil through the reservoir rock at points remote from the wells.

*See Reference No. 2 in first article of this series.

Theoretical analysis of the well-spacing problem on the assumption that fluids may drain effectively over wide areas of reservoir rock, leads some authorities to conclude that widely spaced wells will ultimately produce as much oil as closely spaced wells; but knowledge of the lateral variation in permeability and continuity of reservoir strata, that is characteristic of most reservoirs, suggests that closely spaced wells will usually assure a greater percentage recovery.

The percentage oil recovery obtained in actual field operations varies widely, depending upon the reservoir conditions and method of field exploitation employed.[2] Many authorities have offered estimates of percentage recovery, ranging generally from as little as 10% of the original oil content to as much as 90%. It is difficult to appraise the dependability of such estimates because, in most instances, we have no precise means of determining the original oil content of the reservoir, nor of estimating the residual oil content after all economically recoverable oil has been produced. In laboratory apparatus, we may determine these quantities with certainty, but the high recoveries obtained under relatively favorable laboratory conditions are probably not a dependable guide in estimating the recovery that we might hope to obtain under generally adverse field conditions.

In laboratory apparatus, with uniformly compacted, highly permeable sand representing the reservoir rock, and with drainage occurring over relatively short distances (i.e., a few feet at most), maximum recoveries of about 35% have been obtained from oil-wet sand by solution-gas drive, and as much as 75% by water-drive. Under field conditions however, it seems unlikely that ultimate recoveries will exceed half of the values suggested. The more conservative authorities agree that actual field recoveries seldom exceed 50% of the original oil content of the reservoir and may often be as low as 20%. This is in "primary" field exploitation, using only nature's expulsive forces. Additional recovery may be obtained by the so-called "secondary" methods of field exploitation involving use of external energy, as in injection of gas or water under pressure into the reservoir to supplement nature's forces.

In reservoir drainage studies and in oil property appraisals, it is necessary to adopt some practical method of estimating recoverable reserves of oil and gas. Several different methods have been devised for doing this, none of which is capable of yielding more than approximate values. A method of projection of time-rate production graphs has been widely used and is fairly dependable where conditions are favorable for its use. A method based on estimates of the storage capacity of the reservoir rock, the percentage oil saturation and percentage recovery, must often be used, but uncertainty concerning the criteria involved usually leads to results of uncertain value. Probably the most dependable method yet devised for estimating recoverable reserves of oil and gas is one employing the principles of "material balance."[18] Theoretically, if complete production data and information concerning the reservoir conditions at different times is available, it should be possible by this means to calculate the initial oil content of the reservoir and that at any subsequent date, or after any assumed residual field pressure is reached. Unfortunately, complete information for use of this method is seldom available, but as application of the principles of reservoir engineering progresses, we may expect to find this method more widely employed.

Conclusion. In bringing to a close this review of progress in reservoir technology, we might reasonably conclude that important progress has been made in reaching an understanding of a very complex series of engineering problems. These problems involve interpretation and application of modern physical and chemical principles and familiarity with the earth sciences. Collectively, they represent an important segment of the rapidly developing profession of petroleum engineering.[4]

An effort has been made to present the more important concepts in terms that one having only elementary training in the basic sciences might readily understand. To engineers specializing in reservoir engineering, it will probably appear that the method of presentation has resulted in an over-simplified, purely descriptive version. No effort has been made to appraise the many worthy efforts that have been made during recent years to treat these problems on a strictly quantitative basis.[15] On the other hand, many petroleum engineers feel that some of the more recent scientific papers on different phases of reservoir technology have been so unrealistic in their assumptions of uniformity in reservoir conditions as to be little more than mathematical abstractions. The writer believes that while the quantitative approach is making important contributions to our understanding of reservoir conditions and our ability to interpret field data, we have not as yet reached the point where we can apply the more intricate mathematical concepts with the confidence that an engineer must have in his work.

Though much has been accomplished during the past two decades, research on various aspects of reservoir technology is continuing and for many future years will doubtless offer prospects for new, important information. Each research project contributes its bit of information, and as these bits fall into place, as in a jig-saw puzzle, the picture becomes ever more complete.[9]

Only those well versed in the scientific background of this rapidly developing field of technology are qualified to appraise the value of each contribution to our general fund of knowledge, and to reconcile the conflicting results that sometimes appear. But all who are in any way concerned in the exploitation of oil and gas fields have a stake in this development, and should strive to keep abreast of progress and to obtain a practical understanding of what is being accomplished. Many of the oil and gas industry's important problems have their roots in reservoir technology.[14] Problems of well spacing, well management, secondary recovery, proration, unitization, reserve estimates, property appraisals: all depend upon an understanding of reservoir technology for their correct solution. END

SELECTED BIBLIOGRAPHY

1. *Botset, H. G., "Flow of Gas-Liquid Mixtures through Consolidated Sand," Petroleum Development and Technology, 1940, pp. 91-105, Am. Inst. Mining Met. Eng.*
2. *Buckley, S. E., and R. C. Craze, "The Development and Control of Oil Reservoirs," Drilling and Production Practice, 1943, pp. 9-20, Am. Petroleum Institute.*
3. *Buckley, S. E., and M. C. Leverett, "Mechanism of Fluid Displacement in Sands," Petroleum Development and Technology, 1942, pp. 107-116, Am. Inst. Mining Met. Eng.*
4. *Calhoun, J. C., Jr., "Fundamentals of Reservoir Engineering," University of Oklahoma Press, 1953, 417 pp.*
5. *Calhoun, J. C., Jr., and Yuster, S. T., "A Study of the Flow of Homogeneous Fluids through Ideal Porous Media," Drilling and Production Practice, 1946, pp. 335-355, Am Petroleum Institute.*
6. *Cardwell, W. T., Jr., and R. L. Parsons, "Gravity Drainage Theory," Petroleum Development and Technology, 1949, pp. 199-215, Am. Inst. Mining Met. Eng.*
7. *Hassler, C. L., E. Brunner and T. J. Deahl, "The Role of Capillarity in Oil Production," Petroleum Development and Technology, 1944, pp. 155-174, A.I.M.E.*
8. *Herold, S. C., "Analytical Principles of the Production of Oil, Gas and Water from Wells," Stanford University Press, 1928, 659 pp.*
9. *Johnston, N., and N. Van Wingen, "Reservoir Fluid Flow Research," Drilling and Production Practice, 1945, pp. 201-216, Am. Petroleum Institute.*
10. *Jones, P. J., "Mechanics of Production," 228 pp., and "Optimum Rate of Production," 293 pp., Reinhold Pub. Corp., N.Y., 1946.*
11. *Leverett, M. C., "Flow of Oil-Water Mixtures through Unconsolidated Sands," Petroleum Development and Technology, 1939, pp. 149-171, Am. Inst. Mining Met. Eng.*
12. *Lewis, J. O., "Gravity Drainage in Oil Fields," Petroleum Development and Technology, 1944, pp. 133-154, Am. Inst. Mining Met. Eng.*
13. *Muskat, M., "Physical Principles of Oil Production," McGraw-Hill Book Co., N.Y., 922 pp., 1949.*
14. *Pirson, S. J., "Elements of Oil Reservoir Engineering," McGraw-Hill Book Co., N.Y., 441 pp., 1950.*
15. *Power, H. H., "Significant Research in Petroleum Recovery," The Petroleum Engineer, issues of Feb. and March, 1950.*
16. *Slichter, C. S., "Theoretical Investigation of the Motion of Ground Waters," U. S. Geological Survey, 19th Annual Report, Part 2, 1897-98.*
17. *Uren, L. C., "Oil-Field Exploitation," McGraw-Hill Book Co., N.Y., 1953, pp. 1-99.*
18. *Woods, R. W., and M. Muskat, "An Analysis of Material-Balance Calculations," Petroleum Development and Technology, 1945, pp. 124-139, Am. Inst. Mining Met. Eng.*

Fig. 1. Apparatus for studying two-phase flow through a sand column, University of California Petroleum laboratory.

Fig. 2. Segment of reservoir rock about a well illustrating radial drainage.

Fig. 3. Illustrating form of typical pressure gradient.

Fig. 4. Illustrating form of typical energy gradient.

Fig. 5. Graphs showing influence of connate water on relative permeability to oil and water.

Fig. 6. Sketch demonstrating manner of application of natural explusive forces in oil and gas reservoir.

Fig. 7. Sketch illustrating retention of oil films and gas bubbles between reservoir sand grains. END

Dowell scientist using the Optical Emission Spectrograph to get an accurate analysis of samples sent in from the field.

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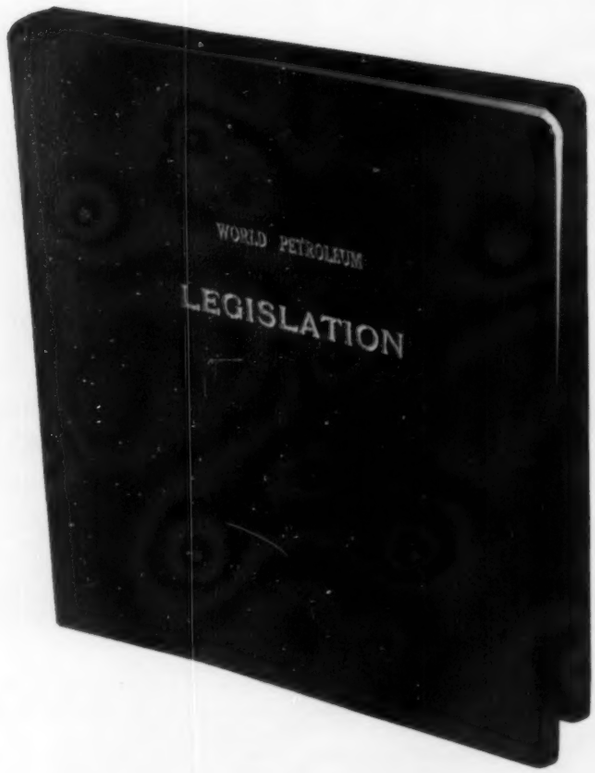
WORLD PETROLEUM LEGISLATION



Summaries of petroleum legislation and/or concessionary arrangements in the following countries have been compiled and will be available soon:

Algeria
Argentina
Australia
Bahamas Islands
Bolivia
Brazil
British Honduras
Chile
Costa Rica
Colombia
Cuba
Ecuador
Egypt
France
Morocco
Guatemala
Haiti
Honduras
India
Iraq
Israel
Italy
Kuwait
Lebanon
Libya
Mexico
Nicaragua
Neutral Zone
Pakistan
Panama
Papua
Peru
Philippines
Portugal
Saudi Arabia
Spain
Switzerland
Syria
Trinidad
Tunisia
Turkey
Venezuela

United States

Summaries are in loose-leaf form and are maintained current as required by the passage of new legislation. They may be purchased in a single volume which contains summaries of all the countries listed, or on an individual country basis. Price range from $10 to $20 per country, up to $190 for the complete set, including revisions for one year.

INQUIRIES SHOULD BE ADDRESSED TO:

WORLD PETROLEUM LEGISLATION

604 FIFTH AVENUE,
NEW YORK 20, N.Y.

WORLD ROYALTY RATES

The petroleum law now under consideration in Italy will set a world's record for royalty rates in unproven areas, if passed. The following summary of royalty rates is extracted from WORLD PETROLEUM LEGISLATION, a new service which contains digests of oil laws of 45 countries, maintained up to date by regular revisions in a loose-leaf volume. Information regarding the service, which will be available for purchase next month, can be obtained through WORLD PETROLEUM, 604 Fifth Avenue, New York 20, New York.

The passage of the new petroleum law in Italy, which has already received the approval of the Chamber of Deputies and will come up for consideration by the Senate this month, will put Italian royalty rates among the highest in the world. There are some which are higher, for example Venezuela where "special advantages to the nation" have brought bids carrying royalty offers up to 25% (offered by the Sun-Atlantic syndicate), but these are all on areas which are considered proven or nearly so and in the heart of the richest oil land in the world, where Italy remains to be tested. Egyptian rates run high also, up to 25%, but this is a special arrangement on conversion of only part of the exploration area.

Under the concept of equal division of profits between the operator and the government these royalties have the effect of putting a minimum or floor under which the company's contribution cannot go. Thus, even in the event of a net loss which would reduce the company's contribution by the income tax to zero, at least the amount of the royalty would have to be paid. In some cases, as in the Neutral Zone, there is a fixed amount below which royalties themselves cannot fall and this would be payable presumably even if operations ceased.

There are several countries which make use of a sliding scale of royalties. Some use it to encourage production in more distant areas in the same manner as lower taxes on distant or inaccessible areas. Thus in Argentina, rates vary from nine to 12% depending on the distance from port facilities, production rates and transportation facilities available. Bolivia also gives reduced rates on the more inaccessible parts of the country, or on areas which are considered less favorable. Colombia has also adopted this system, as has Ecuador. France is an unusual example of a major European area which has partially adopted this same system, generally it is restricted to Latin America. As an incentive to production, many countries give lower rates on higher levels. This is the case in Argentina.

Although it would seem logical that royalty rates could decrease with rising production levels as an incentive to higher production rates the opposite is true. Generally the higher production, as in France, Costa Rica, Italy, Nicaragua, Trinidad and others, pays a higher royalty rate. The use of rates to encourage exploration, as previously mentioned, is common as is their use to encourage refining as is done in Cuba and in Venezuela, the latter imposing a royalty penalty on "refining in areas not considered consuming areas."

WORLD ROYALTY RATES ON CRUDE OIL PRODUCTION

Country	*Amount*	*Remarks*
Argentina	9% to 12%	Reducible to 9% depending on production, transportation and distance.
Australia	5% to 10%	Western Australia rates.
Bahamas	12½%	Levied on sales value of production.
Bolivia	11%	May be reduced in Zones 1 & 2 to 7½% for 15 years.
Brazil	10%	Production restricted to government or nationals.
British Honduras	12½%	Levied on sales value of production.
Colombia	3% to 13%	On government lands depends on distance of producing site from coast. Offshore royalty 10%.
Costa Rica	10% to 16⅔%	10% below 5,000 b/d production, 16⅔% on over 15,000 b/d (Based on Union Oil contract, no petroleum law).
Cuba	11%	10% goes to govt., 1% to land owner. Reducible to 9% if producer refines in Cuba.
Ecuador	5% to 11%	Varies with distance from nearest port, 11% 1 to 50 kilometers, to 5% over 600 kilometers.
Egypt	15% to 25%	15% on first half of converted exploration area, 25% on second half, 25% throughout on extension.
France	6% to 14%	6% on production of 1,000 b/d, rising to 14% on 20,000 b/d. Reducible with distance by .02% on production 500 to 600 kilometers from point of export, .04% when distance is between 500 and 700 kilometers and .02% per 100 kilometers thereafter.
Guatemala	12½%	4% of royalty goes to surface owner.
Haiti	10%	Represents maximum royalty.
Honduras	5%	2% of royalty goes to surface owner.
Italy	2.5% to 22%	2½% on production per well to 30 b/d, up to over 1,920 b/d production. (Proposed Law.)
Libya	12½%	Payable on market price in nearest port.
Neutral Zone	33¢-55¢	33¢ per barrel payable by Aminoil, 55% by Pacific Western.
Nicaragua	7% to 9%	7% on first 2,000,000 barrels production, 9% on production over 500,000 barrels.
Panama	16⅔%	
Papua	10%	
Philippines	12½%	
Spain	5%	
Switzerland	4% to 15%	4% in Bern Canton, 3% in Vallais, 4% in Ticino (plus 2% to concession holder and 1% to discoverer and 15% in Geneva canton.
Trinidad	10% to 12½%	Varies from 10% on production up to 350,000 barrels in half-year period to 12½% on production over 550,000 barrels in half-year period.
Turkey	12½%	
Saudi Arabia	12½%	
United States	12½%	Represents minimum Federal rate on proved properties.
Venezuela	16⅔%	Maximum rate established in law. Higher rates payable for special area bids.

The non-propelled floating tender has become the trademark of the offshore oil business. Anchored to the drilling platform, these units provide luxurious accommodations for the crew plus power for the rig and have proved the most economical and fastest offshore drilling method yet devised. Gulf shipyards are loaded to capacity with orders for such units as were seen recently with the launching of.....

New Floating Tenders for Offshore Work

By James W. Calvert

WITH those words the Levingston shipyards witnessed last August the rarest of sights—a sponsor who broke the bottle of champagne on the very first swing.

The recipient of this "very first try" was one of two 260-foot offshore drilling tenders built for the Reading and Bates Offshore Drilling Co. at the Orange, Texas yard of Levingston Shipbuilding Co. The sponsor with the Mickey Mantle-type swing was Mrs. J. W. Bates, the wife of one of the founders of the company for whom the vessel was named.

Both the Reading and Bates tenders were christened on the same day, but Mrs. George M. Reading, sponsor of the vessel named for her husband, fell into the more popular category of the "hundreds" who smashed the traditional bottle on the second try.

The double-christening ceremony was but one of a series of such events that have taken place during the last few months in the overworked Gulf Coast shipyards, jammed with mobile drilling units, permanent platforms and other tools being built for the offshore oil industry.

Non-propelled drilling tenders, each with innovations designed to cut the enormous costs of offshore drilling, also have been completed recently by Equitable Equipment Co. at its Mandeville, Louisiana, shipyard and by American Marine Corp., formerly Alexander Shipyard, in New Orleans.

In the Reading and Bates facilities, Levingston claimed a "first" by producing a completely packaged offshore drilling unit, consisting of the tender, drilling platform and a compact, unitized structure which contains all of the necessary drilling machinery and can be neatly lifted into place in two simple operations.

Equitable's "first" was a diesel-electric powered drilling tender built for Kerr-McGee Oil Industries which supplies electric power to the drilling rig, while American Marine converted a wartime-LST into an all-electric drilling tender which has the added advantage of carrying its own drilling rig on deck.

The latter vessel, recently delivered to Delta Marine Drilling Co. of Tyler, Texas and named for its president, Joseph Zeppa, contributed another "first" to the offshore oil industry by supplying an A.C. rather than a D.C. electrical system, thus providing maximum safety and minimum maintenance.

After three years of intensified operations in the submerged oil fields of the Gulf of Mexico, off the Texas and Louisiana coasts, the drilling tender has become standard equipment for the seagoing oil men.

There are three methods of drilling at sea. The mobile platform, or submersible unit which can be moved from one location to another, is becoming the standard method of wildcatting. Once a field has been established the usual procedure is to build giant self-contained platforms, from which multiple wells can be drilled, or to utilize small permanent platforms which can be serviced by floating tenders. The latter is by far the more popular and less expensive method.

The tender, anchored head-on to the drilling platform and connected by flexible catwalks, hose and electric power connections, serves as power plant, warehouse, mud pit, and living quarters for the drilling crew at sea. Because the crews are required to spend long tours of duty aboard the offshore tenders, the drilling contractors and oil companies have made life for them as pleasant as possible, providing air-conditioned quarters whose appointments compare with those of the finest hotels.

The two Reading and Bates non-propelled tenders are similar in design to the five other tenders built by Levingston during the last two years. Built to class under rigid inspection of the American Bureau of Shipping and the U. S. Coast Guard, this type tender is 260 feet long, with a molded breadth of 54 feet and molded depth of 18 feet 3 inches.

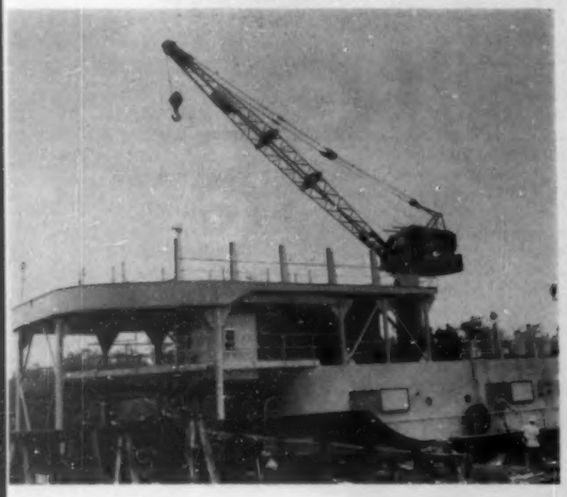
The main engine drive group consists of three Waukesha diesel engines feeding into a compound which drive two National G-1000 mud pumps. Electric power for lighting and auxiliary services is provided by two 225 KW Columbia generators, driven by air-starting Caterpillar diesel engines.

Storage facilities include four bulk mud bins built on the main deck, with a capacity of 1,100 sacks. Reserve mud pits hold 1,538 barrels of drilling mud and active pits have a capacity of 554 barrels. Fresh water storage consists of two tanks each with 630-barrel capacity and drilling water tanks can store an additional 13,000 barrels.

Drill pipe, tubing and casing are stored on racks on deck and can be transferred fom supply boats and to the drilling platform by means of a 75-foot boom crane.

In the forward superstructure are comfortable air-conditioned quarters for fifty men, each room being equipped with indi-

The first diesel-electric drilling tender to be built for Gulf Coast offshore oil operations is the tender "KERMAC III," built by Equitable Equipment Co. for Kerr-McGee Industries. The "KERMAC III" has a heliport on top of the living quarters.



A sistership to the "J. W. BATES" is the tender "J. C. CRAIG," built by Levingston for the CATC group, shown on drilling location in the Gulf of Mexico.

The "CLAYTON C. DORN" owned by Llano Drilling Co., is towed to sea for its first offshore job. Levingston has completed six of these giants, now has two others under construction.

vidual temperature control. There is a modern galley, well equipped with stainless steel kitchen appliances, spacious dining rooms where crews are served cafeteria style, thirty-two men at a time, and a well-appointed recreation room.

The roof of the superstructure forms a 64 x 54 foot helicopter flight deck.

What makes the Reading and Bates facility unique, however, is the Levingston-designed drilling platform power unit which weighs slightly more than 300 tons and is compactly arranged on two structures. To facilitate handling at sea, the two sections can be lifted to a drilling platform and bolted together with eight bolts, four to the side.

The unit is 64 feet long, 40 feet wide and 30 feet high. One section contains the drilling power unit, consisting of two Waukesha model VLRDBS diesel engines which supply power to the drawworks and rotary table as well as to an auxiliary mud pump, and a Caterpillar diesel auxiliary generator.

The second section consists of the derrick floor, with the driller's console, degasser, bug blowers, and other necessary drilling equipment. This compact unit can be entirely self-contained in the event the tender must be moved from the drilling platform. Auxiliary power plants and mud pumps can be put into operation to permit work to continue independently of the tender's power facilities.

The machinery of this unitized rig consists of an Ideal two-section type B-18G-1$\frac{1}{20}$ drive group complete with the two Waukesha engines and Ideal Gyrol No. 270 fluid drives, Worthington 2½ CFI pump and Westinghouse 5YC-1 air compressor. There is an Ideal C-250 mud pump, Ideal type MS rotary, Ideal 130 drawworks, 40 kw Caterpillar generator, a Schlumberger unit, and built-in water and fuel tanks.

Its designers believe this to be the first unit ever built with all drilling machinery mounted on a single foundation that could be lifted bodily into place.

Reading & Bates Offshore Drilling Company is one of the newer concerns to enter the field of submerged drilling. The first of the two tenders to be completed, the "J. W. Bates," is under contract with the CATC group composed of Continental Oil, Atlantic, Tidewater and Cities Service. The second Reading and Bates tender, the "George M. Reading," was approximately 25% complete at the time of the twin christening ceremony in August.

Also working for the CATC group is the newly completed Kermac Drill Tender III, Kerr-McGee's diesel-electric tender which utilizes GM Electro-Motive locomotive units. Kermac III was the first offshore tender to supply electric power for drilling. Most offshore wells get their mud supply from tenders but have power units on the platforms to operate drawworks and rotary table. The Kerr-McGee tender supplies all power, although the platform is equipped with a stand-by unit in the event it is necessary to move the tender away from the rig.

The power plant of the Kermac rig consists of three units, each composed of an 875 hp Electro-Motive Model 567-C diesel engine driving two 500 kw Model D-39-G direct current generators and their exciters. Two of the units are permanently installed in the tender. The third is for the drilling platform and can be used in conjunction with the tender power plants or separately, in the event of an emergency when the tender might be forced away from the platform because of weather. Electric traction motors, similar to those which drive electric locomotives, actually operate the drilling machinery, getting their power directly from the generators aboard the tender.

Other than the electric power plants, the layout of the Kerr-McGee tender is similar to other such vessels designed and built at the Equitable yard. There are storage facilities for 13,000 barrels of drilling water and 24,000 gallons of diesel fuel, two Emsco D-1000 mud pumps, a Halliburton cementing unit, storage for pipe, cement and bulk drilling mud, and the usual air-conditioned living quarters and heliport.

The latest drilling tender to go into service, Delta Marine Drilling Co.'s "Joseph Zeppa," also is a diesel electric power plant but is unique for drilling operations in that AC power is utilized in driving the mud pumps and draw works. Its designers claim that the AC application accomplishes speed and torque control by use of D.C. rectifier-supplied eddy-current couplings.

The engineers point out numerous advantages in this type of electrical system. First, all drilling equipment requirements and ship service are drawn from a common 3 phase, 440 volt, 60 cycle system. Because AC motors do not have the sparkling tendency common to D.C. motor commutation, the system introduces a safety factor through reduction of explosion-proofing problems.

The main power plant consists of two General Motors model 12-567A diesel engines, rated 1,080 hp at 720 rpms, which drive two 750 kw Allis Chalmers generators. The auxiliary service plant is a single 3-268A GM diesel engine, rated 150 hp at 1,200 rpms, which drives one 100 kw Westinghouse generator.

Drilling equipment on a separate platform, which is a part of the overall unit, includes an Emsco J-1250 drawworks with selective transmission, driven by two 700 hp Westinghouse 440 volt, 3 phase, 60 cycle electric motors. The Lee C. Moore derrick substructure, with Cantilever to accommodate the drawworks, is mounted on skid beams. The derrick is a 30′ x 30′ x 140′ Lee C. Moore type K, 1,100,000-pound capacity.

The tender is equipped with one Bethlehem Delco 600 and one Bethlehem G85 slush pumps, while on the drilling platform is an Ideal C-250 standby pump, driven by a 400 hp electric motor coupled through a No. 8 Elmagoo coupling.

Another feature of the "Joseph Zeppa" is its deck arrangement which permits the entire drilling unit to be carried by the tender itself, thus eliminating the need for a separate barge to move the drilling equipment to the platform at sea. The tender merely draws alongside a permanent drilling platform and the drilling equipment is lifted by the vessel's 30-ton derrick.

The tender, a converted LST 328 x 50 x 28 feet, was reconstructed, equipped and outfitted in strict accordance with ABS, U.S. Coast Guard and Public Health Service regulations. In addition to the power plant, main mud pumps, active and reserve mud pits, and other mechanical services on the tender, there is also the usual fully air-conditioned, mahogany-panelled quarters for 48 men with two recreation rooms, large cold-storage rooms, galley and mess hall. A four-man hospital is provided and a helicopter deck is located over the quarters.

The christening of the "Joseph Zeppa" took place on August 25. There was the traditional cocktail party, the blink of flashlight bulbs, the walking tour of the vessel, the customary congratulations to officials, but something seemed to be missing.

The ladies retired to the air-conditioned comfort of the living quarters, to admire the decor and the comparative luxury which will be afforded drilling crews of the Delta Marine Company.

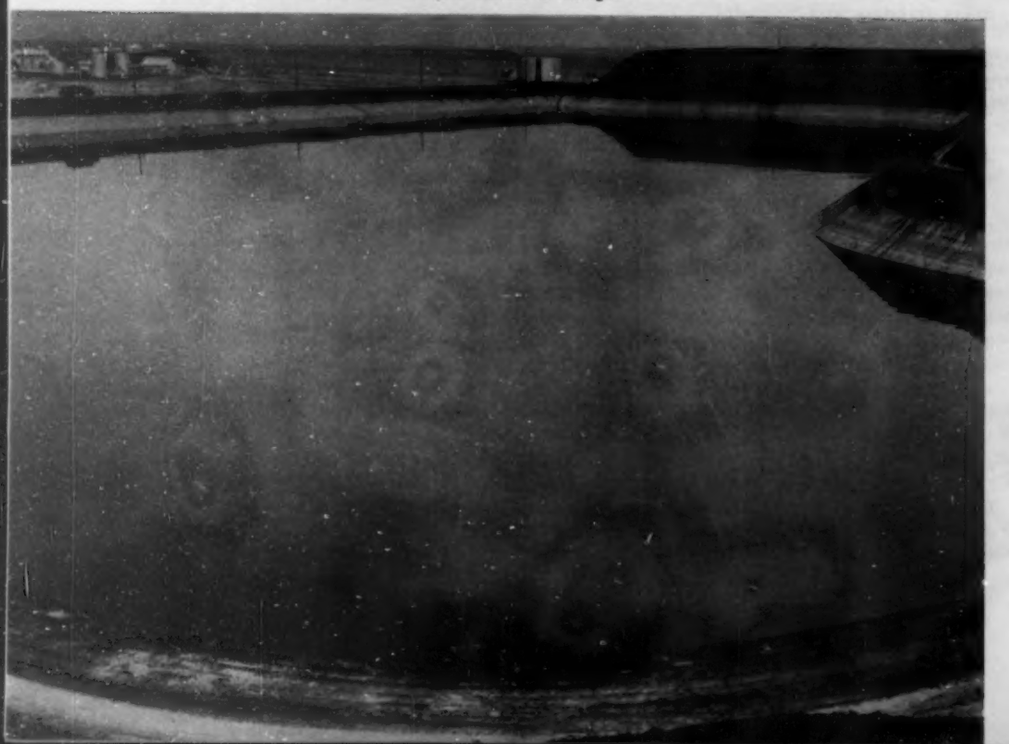
"When are you going to break the bottle?" somebody asked Mr. Zeppa.

"Oh, we're not going to break a bottle," answered the amiable president of Delta Marine. "We drank all the champagne last night."—END.

Photograph of site before construction was begun.

Construction in progress.

Completed reservoir with about 700,000 barrels in storage.



RESERVOIR

EARLY in 1955, it was decided that an additional 3,500,000 barrels of fuel oil storage would be required at the Amuay Refinery by Sept. 1st, to meet the forecasted sales demand for the winter 1955-1956. Since there was insufficient time to erect conventional steel tanks, it was decided to construct an earthen reservoir if soil conditions and costs permitted.

Of several sites in the Amuay area considered, one along the shore of the bay below the cliff line was selected. The shore in the vicinity consists mainly of salt flats and low areas of clay, blow sand, and silt washed down from the cliff. The site selected is a pocket between the road and cliff. It is roughly 330 feet wide by 1,300 feet long with an average elevation of 13 feet above mean low water. The cliff is 75 feet high with clay extending from the base to the 6 foot thick cap of limestone. The fuel oil storage tankage is on the mesa immediately above the area. (See Figure No. 1). A preliminary survey and examination of the soil indicated the site was satisfactory and that construction costs would be reasonable. Undisturbed soil samples from the area were sent to Dr. T. William Lambs of Massachusetts Institute of Technology, for study and recommendations. The firm of Lopval, C.A., was employed to make soil borings in the area to determine the subsoil conditions.

Because of the lack of experience in the use of earthen dams in oil service all design information and recommendations were based on laboratory results. The tests indicated that the clay in the site selected is an excellent material for the construction of a dam and impervious compacted clay bottom for the reservoir. Oil permeation tests employing a pressure equal to 60 feet of oil showed that the permeability of the compacted clay to oil was essentially zero. As a matter of fact in none of the oil penetration tests conducted was there any significant penetration of oil into the compacted clay. Tests to determine the effect of dispersants on the liquid limit of the clay indicated that sea water was as effective a dispersant as any of the added chemicals.

Nineteen soil borings (Gow method) to a depth of 50 feet were made in the area. The tests showed a soft material, 0 to 3 blows per foot, in some areas within the

Working 20 hours per day last summer, Creole Petroleum Corporation built an emergency open reservoir, capable of storing 3,500,000 barrels of fuel oil. The installation operated successfully through the winter season with little or no loss.

MEETS PEAK FUEL DEMAND

dam site. The thickness of the material varied but in general increased toward the beach. Additional borings were made to a depth of 8 feet with a 24-inch power post hole digger along the centerline of the proposed dam. Samples from these borings showed the low blow material to be soft blue clay with a high moisture content. Since the thickness and location of the material was not extensive it was decided that the water released during the compaction could be handled by a drainage structure in the dam. The results of the soil borings also indicated that there would be some settling of the dam and a smaller amount of the bottom of the reservoir.

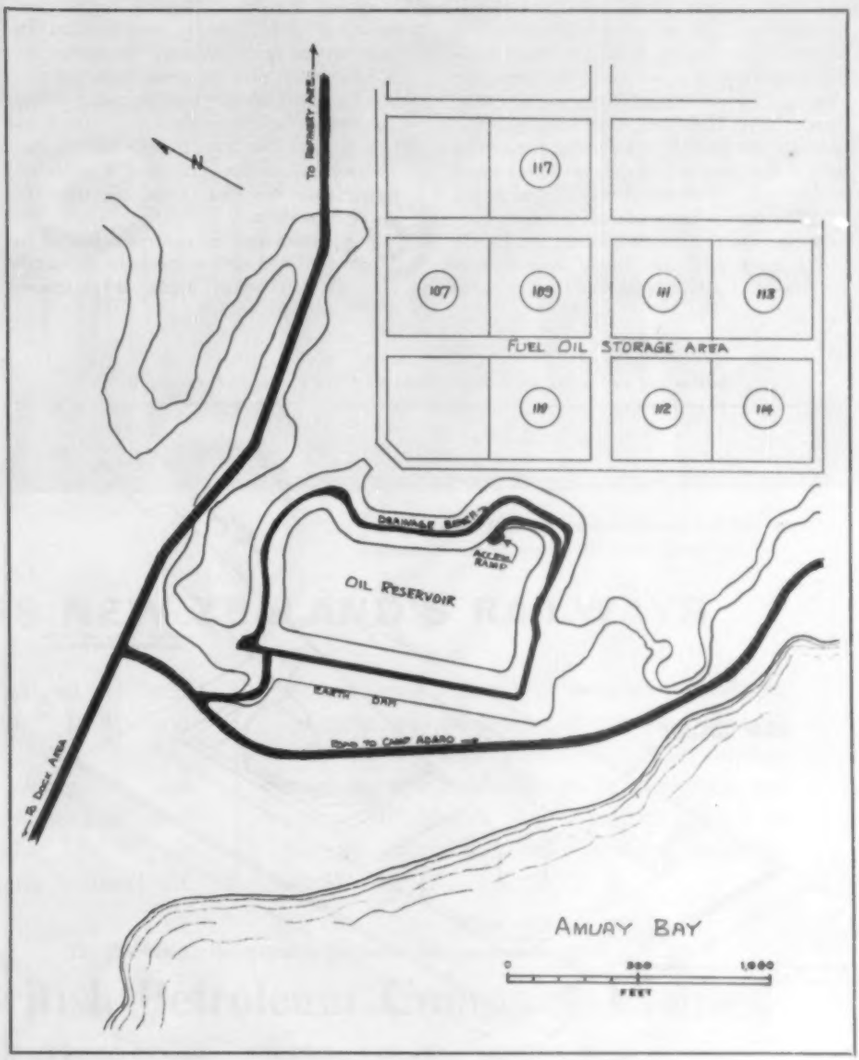
Based on laboratory and field tests, a symmetrical dam 43 feet high with a 13 foot wide crown and side slopes of 1.5 to 1 in the upper half and 2.5 to 1 in the lower half was designed. (See Figure No. 2). The length of the dam is 1,246 feet. The elevation of the finished bottom at the lowest point is 4½ feet above sea level and the crest of the dam 51 feet.

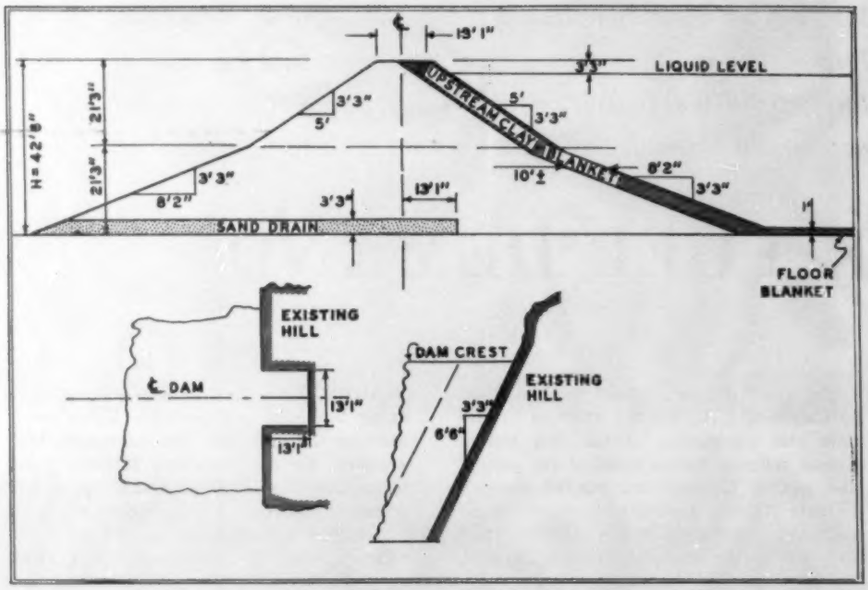
To accelerate the draining of the soft blue clay under the dam a sand blanket 3 feet thick and extending from 6½ feet inside the center line to the outside toe was provided. The side slopes were sprayed with two coats of cut-back asphalt. A topping of crushed rock and asphalt was placed on top of the crown. Along the cliff line the back slopes were cut to 1.5 to 1 with 10 foot wide bench at the 50 foot elevation. This bench is to provide access to all sides of the reservoir and also carry off rain water from the upper slopes. The face of the cliff was sprayed with two coats of cut-back asphalt. An access ramp for maintenance equipment to enter the reservoir was constructed along the cliff line.

A single 20-inch pipe line from the refinery fuel oil manifold was used for filling and discharging the pit. Two 1,752 gpm rotary pumps powered by 200 hp electric motors handle the oil from the reservoir. The pump suctions are connected to the intake structure by two 24-inch lines through the dam. Each pump has two suctions, a high suction inside the 18-inch skimming wall, and a low suction in the bottom of the reservoir. (See Sketch No. 3). Water drawoff is handled by a 250 gpm pump manifolded to the lower suction and discharging to the refinery separator through a 4-inch line.

The construction contract was awarded to Caminos, C.A., for the erection of the dam and compaction of the clay lining. Creole refinery forces installed the pumps and piping. Construction started June 7 (Figure No. 4 is a photo of the area before starting construction) and by working a full 20 hours a day was completed by August 30th. Stationary flood lights were installed along the dam and portable lights were used on the cliff line. The contractor had available for the work two 12-cubic yard turnapulls; five 12-cubic yard scrapers and tractors; two regular type highway sheeps foot rollers and tractors; two rubber tired rollers; three D8 bulldozers; three road

Map of storage area.





Vertical section along center line of dam.

patrols; two pulvimizers; one dragline and several water trucks. A soil and clay control laboratory was set up at the work site and continuous compaction, moisture, and density tests were run. Control rods were placed at 66 foot intervals along the center line of the dam to measure settlement and to detect the presence of water level in the fill. The rods were made of one inch sectional brass tubing with a flange welded on the bottom and the lower section was perforated. Elevations of the flanges were recorded daily. During construction the dam settled approximately six inches and it is expected that the settlement will continue at a decreasing rate for about a year. To provide for the settlement an additional two feet of fill was placed in the dam. There has been no indication of water entering into the dam structure from the lower formation.

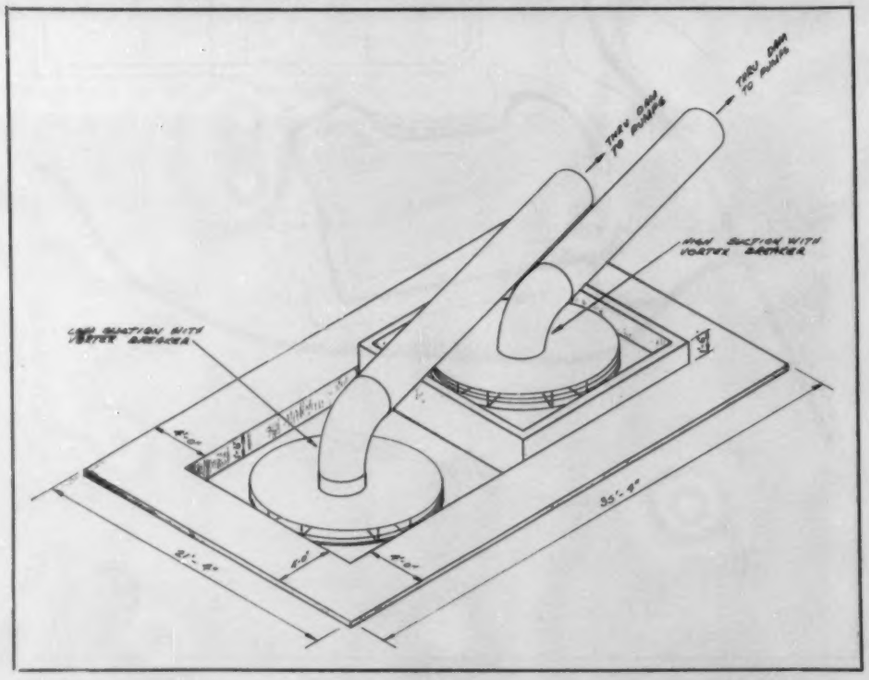
The bottom and the upstream face of the dam were lined with a specially compacted material. The dam lining is equipment width thick and the bottom is eight inches thick. In these areas the soil was thoroughly worked with pulvimizers and then rolled with rubber tired rollers. (See Figure No. 5, view of construction in progress). Selected material was used for the dam lining and the material in place was worked for the bottom. The specifications for material in these sections were more severe than for the dam: liquid limit greater than 30%; largest particle ½ inch; percent finer than 200 more than 35%. For compaction the dry density was held at more than 90% and water content at the optimum plus two. Due to the high moisture content of the material in its natural state moisture control was difficult at times. The dry density of the material ran around 116 pounds per cubic foot.

During the construction 12 million cubic feet of material were handled of which approximately 25% was spoil. The spoil material was placed below the downstream toe of the dam for an overburden. The completed reservoir has a capacity of 3,750,000 bbls. at the 46 foot level which provides three feet free board on the dam and below the bench. During the period that the reservoir was filled the wind velocity was considerably less than normal. However, on several days when the velocity did approach the average for the year, no wave action was apparent on the oil surface.

Fuel oil was turned into the reservoir Sept. 5 (Figure No. 6 is a view of reservoir with approximately 700,000 bbls. in storage) and on Oct. 21, 3,500,000 bbls. were in storage. The temperature of the oil to the reservoir was approximately 150-160°F, viscosity 165-175 SSF at 122°F and flash point 180 to 200°F. During the months of September and October it rained 7.1 inches which is considered exceptionally high for the area which has an average yearly rainfall of 11 inches. No serious erosion or slides occurred in the dam or back slopes and tests on the oil in storage indicated that the rain water settled out in a short time. Water is pumped out through the lower suction connection and discharged into the refinery separator.

The procedure for loading oil from the reservoir is to pump it into a 150,000 barrels steel tank for blending with 20 to 30% hot fuel oil from the refining units. Running into the tank provides the facilities for gauging the reservoir withdrawals and ships' cargoes. During November the temperature of the oil in the reservoir averaged 95°F, viscosity 171 SSF at 122°F and flash point 230°F. The low temperature in the pit would restrict the loading rate if the fuel were not heated by the hot oil. Additionally it was believed the oil in the reservoir might go off specification due to high viscosity of bs&w. To date the viscosity has been on test even though some evaporation has occurred. Minor difficulty has occurred with high bs and w contents but it has been readily corrected. In early December, the reservoir storage had been reduced to 1,600,000 barrels, and it was out by the end of March. END

Suction pad and vortex breaker with lines for filling and emptying reservoir.



A New Zealand Railway's publicity photograph showing a steam locomotive, fired by BP heavy furnace oil.

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Oil Company Staff Changes

B. R. DORSEY has been appointed coordinator in the Gulf Oil Corp.'s manufacturing department. Mr. Dorsey succeeds the late E. J. Kirberg. Mr. Dorsey was transferred to Pittsburgh in 1955. He will continue to be located in the General Office, Gulf Building, Pittsburgh.

HOWARD M. TEMPLE has been appointed secretary and C. H. Calvert, Jr. production manager of Commonwealth Oil Co. of Houston. Until recently, Mr. Temple was legal adviser to the Pan American Production Co.'s land department, and was formerly with Hunt Oil Co. in Dallas. Mr. Calvert will be in charge of Commonwealth's drilling and production activities in the Gulf Coast, South Texas and South Louisiana areas.

FRED H. KAYE has been appointed office manager for the Philadephia general sales department of Sun Oil Co. He succeeds M. B. Parmalee, whose new assignment will be announced at a later date. Mr. Kaye joined Sun Oil Co. in 1933.

J. L. IRVIN has been named general manager of the domestic pipe line department for the Gulf Oil Companies. Walter L. Shannon has been named manager of domestic pipe line operations. They will continue in Houston. Both are veteran pipeliners; Mr. Irvin started with Gulf in 1917 and Mr. Shannon in 1920.

CALDWELL STARKEY has been named district geologist for Jamaican Stanolind Oil Co. at Kingston, Jamaica. He transfers from Corpus Christi, Texas, where he was district geologist in charge of exploration for Stanolind. In Kingston he will have supervision of all exploratory activities on the island and submerged lands.

Jamaican Stanolind holds an exclusive oil and gas prospecting license from the Jamaican government on the island and for offshore areas an average distance of 12 miles from shore. The company spudded its first wildcat June 3 in the Santa Cruz mountains southeast of Malvern.

PHILIP A. KAHLE, JR. has been named manager of refining for the Frontier Refining Co., Cheyenne, Wyoming. He was formerly vice-president of Refinery Engineering Co. division of Vitro Corp. He joined Refinery Engineering as a project engineer on Oct. 20, 1950 and made a vice-president in August, 1953.

WALLACE E. AVERY, new secretary of The Texas Company, succeeds Walter G. Elicker who retired after 38 years with Texaco. Mr. Avery has been assistant secretary since January, 1954. He joined Texaco in 1945 as an attorney in the Los Angeles office. In 1951 he was made assistant general manager of the industrial and public relations department, with headquarters in New York.

Wallace E. Avery

RALPH D. JACKSON has been promoted to chief engineer of the Sohio Pipe Line Co. Mr. Jackson will be responsible for the planning, design and construction of Sohio's major transportation facilities.

W. L. BUTTE and **R. E. MAYS** have been elected to the board of Creole Petroleum Corp., with headquarters in Caracas, Venezuela.

E. Jones and W. A. Greeven have resigned to accept positions with the parent company, Standard Oil Co. (N.J.). At the same time D. E. Stines was elected vice president in the New York office.

DR. CARL O. TONGBERG has been elected a vice president and director of the Carter Oil Co. He leaves the post of vice president and director of Esso Research and Engineering Co., and will be in charge of production research activities conducted by Carter. Dr. P. S. Williams will continue as head of the Carter Oil Co. Research Laboratory in Tulsa.

Dr. Tongberg holds a bachelor of science degree in chemistry (1927) from Harvard University. Following his graduation, he worked as an assistant to Dr. James B. Conant, former president of Harvard and now U. S. Ambassador to Germany. He joined Esso in 1937 at Linden and became assistant director of the company's products research division in 1945 and director of the division in 1951. He was elected a vice president and director of the company in 1954

T. H. TONNESSEN has been designated assistant to the treasurer; V. J. Motto has been named finance manager and T. R. Lilley has been appointed investment manager of Standard Oil Co. (N.J.)

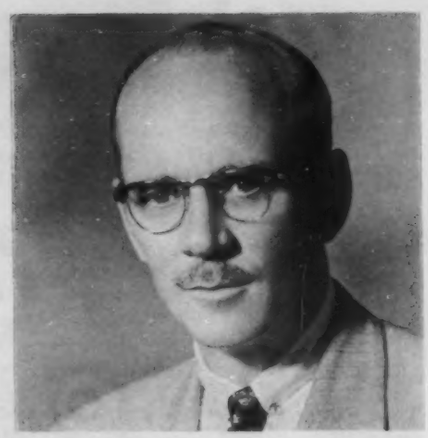
FRANK J. WEESS, formerly manager of the New England marketing district for Tidewater Oil Co. in its Boston office, has retired. He had been a Tidewater employee for the past 33 years.

R. MAYSON FOSTER has been appointed general auditor, and Adam P. Yung has been appointed manager of the new systems and procedures division of the comptroller's department, Gulf Oil Corp.

NICHOLAS J. CAMPBELL, JR., has been appointed a member of the legal department of Standard Oil Co. (N.J.) in New York. Mr. Campbell formerly was manager of the law department of Creole Petroleum in Caracas, Venezuela, until he recently was elected a director of that company.

HARRY A. JACKSON has been elected president of American Petrofina, Inc. Mr. Jackson was formerly vice president and general manager of Tidewater Oil Co.'s eastern operations.

Harry A. Jackson



George W. Butler

GEORGE W. BUTLER, manager of Esso Standard Oil Co.'s (N.J.) sales division, has been named manager of the marketing development division of the marketing coordination department of Jersey Standard.

A. W. Tarkington

Harold G. Osborn

HAROLD G. OSBORN, vice president in charge of manufacturing, Ponca City, has been appointed senior vice president, Houston, of Continental Oil Co. A. W. Tarkington, vice president and regional general manager, Fort Worth, has been named senior vice president. R. L. Bosworth has been appointed vice president.

L. C. Peters has been named financial vice president and treasurer at Houston and G. T. Pearson will be the new regional general manager at Fort Worth.

W. C. (Bill) TALBERT has been appointed sales manager for Mission Manufacturing Co., Ltd., with headquarters in London. Mission Ltd. is the overseas subsidiary of the Houston company. Mr. Talbert has been assistant export sales manager of the Houston concern with headquarters in New York City. Previous to that time he was with the company in Venezuela as a field service engineer.

W. C. (Bill) Talbert

What about the bits for this location? This is wildcat territory! But you know... *from long experience*... that Hughes bits of the right sizes, types and design will be ready for delivery before you spud in.

The same is true of the other fifty thousand or more rotary wells to be drilled during the next twelve months. By working closely with the industry the Hughes organization determines, *accurately and far ahead of time,* the bit requirements for each drilling area... and the wildcats, too!

Oil Compan

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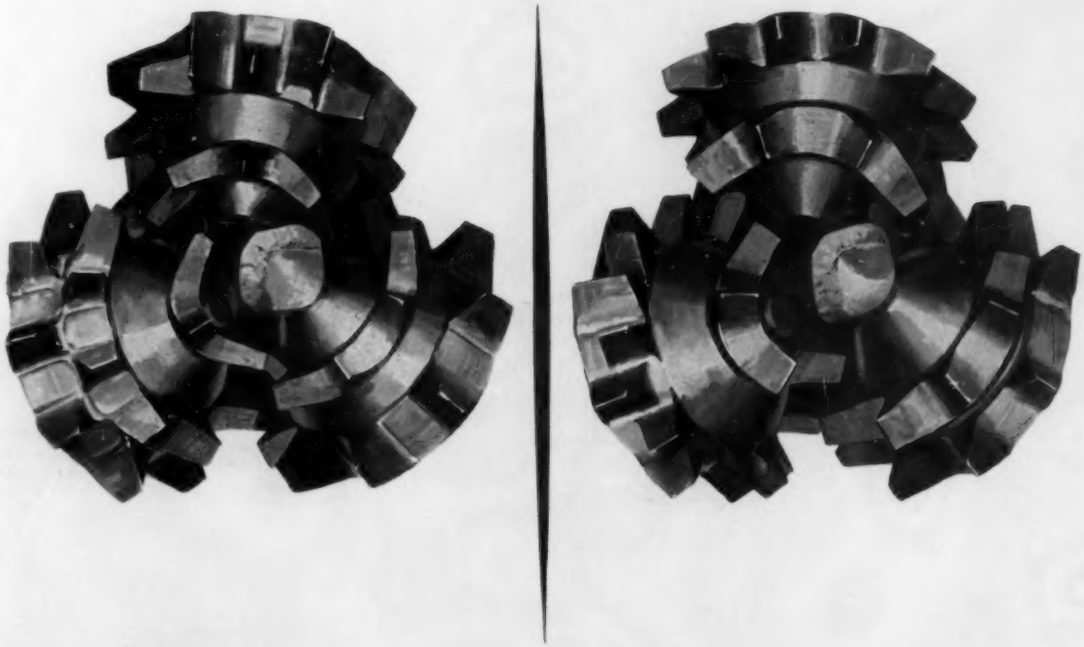
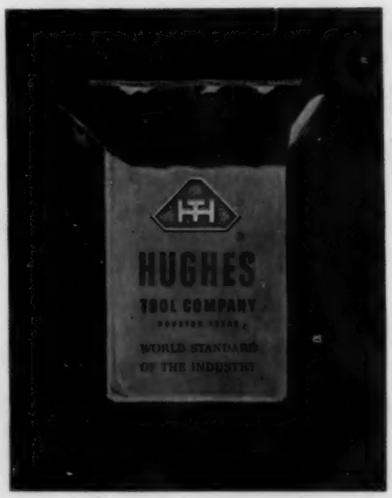
Wallace E. Aver

THEY LOOK ALIKE ... but



there's a difference in their performance

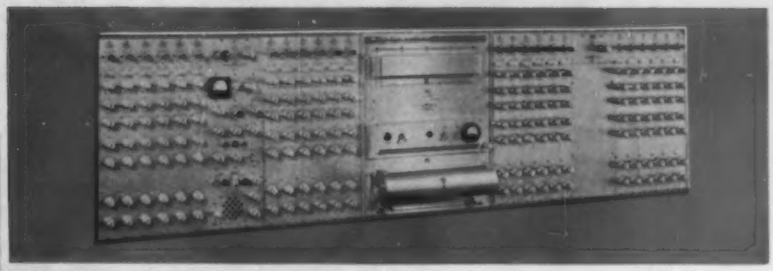


The two rock bits pictured here are excellent examples of the fact that bits that may look alike don't always perform alike.

Both bits are similar in design. But changes have made the second bit a faster cutting, better-performing, more versatile bit ... capable of drilling a wider range of formations.

Hughes bits are undergoing constant improvement based on continuing research and the world's greatest rock bit experience—over one billion feet of hole drilled in the past 47 years. That's why you can depend on HUGHES bits to consistently drill more hole faster!

SIE G-22A SEISMOGRAPH SYSTEM



for high-production Operations

FREQUENCY RESPONSE: Within 3 db from 10 to 500 cps. Filtering as specified.

LOW DISTORTION: Less than 1% from 10 to 500 cps at 0.1 volt input.

AGC CONTROL RANGE: 0.5 microvolt to 0.1 volt input. (Three time-constants selected from front panel.)

GAIN CONTROL CIRCUITS: AGC, Expander, or simultaneous AGC-Expander operation.

RECORD PRESENTATION: Single record. Dual output. Dual record.

- First-Arrivals Unfiltered.
- Individual Channel Paralleling and Testing Switches.
- Simplified Controls.

Features essential to high-speed operation—available only on special order in many systems—are standard equipment in the G-22A.

New circuitry provides unmatched performance with all recording methods while simplifying matching and operating procedures.

AGC Time-Constants, mixing method and percentage, and type of record presentation can be selected from the front panel. Two attenuation rates on both high and low cut filters provide hundreds of filtering combinations.

From the new self-biased AGC circuit to the simplified control panel, the G-22A's "field engineered" design combines practical operation with high flexibility.

227-56

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London Letter

By E. Lawson Lomax

How Suez Affects Britain

Although Suez is not a purely British crisis, it has a direct effect on the British petroleum industry. Total British refining capacity is now about 30 million tons yearly (600,000 b/d), with considerable additions to capacity now underway. The major portion of this capacity has been designed to handle Middle East crudes. This, however, does not mean that the plants can handle only Middle East crudes, as there is no practical reason why, with minor alterations, they can not be altered to handle other types of crude oil.

If supplies of Middle East crudes were curtailed by closing of the Suez Canal, considerable inconvenience and a large monetary loss would result, the industry is so flexible, however, that the inconvenience and loss would not be permanent.

In the event of a Suez shutdown by Egypt, it is probable that shipments by Tapline, which amount to about 400,000 b/d, could be increased to 500,000 b/d through additions to capacity. Kuwait would support the oil nationalization in some manner but probably in such a way as would not affect too greatly her oil income. Iran, not being an Arab country, would probably not support the move at all, even in the event a call by Egypt for complete denial of Middle East oil to the West. This is particularly true in view of Iran's desperate need for oil revenues to undo the damage done during her own nationalization period. Iraq would probably favor increased shipments through pipelines to the Mediterranean in the event of a Suez shutdown, including the diversion of the southern producing fields to the pipeline system, rather than utilization of tankers through the Canal as has been done until now.

Interests of the various countries in production of crude in the Middle East are divided up as follows:

MIDDLE EAST DIVISION OF FIRST SIX MONTHS PRODUCTION BY OWNERSHIP

(Long tons)

	British	Royal Dutch Shell	French	U.S.A.	Gulbenkian
Iraq	3,970,897	3,970,897	3,970,897	3,970,897	835,978
Qatar	602,311	602,311	602,311	602,311	147,855
Iran	4,856,000	1,699,600	728,400	4,856,000	—
Kuwait	14,405,375	—	—	14,405,375	—
Aramco	—	—	—	25,752,162	—
Neutral Zone	—	—	—	750,000	—
Bahrein	—	—	—	750,000	—
	23,834,583	6,272,808	5,301,608	51,086,745	983,833
Percentage	27.1%	7.1%	6.0%	58.2%	1%

All the crude delivered by the Iraq Petroleum Co. and the Mosul Petroleum Co. was loaded at Banias or Tripoli, and it can be estimated that 7.5 million tons of Saudi Arabian crude was delivered through Tapline to the Sidon terminal, a total of about 20 million tons out of a total half year's production of nearly 88 million tons.

The difference of 68 million tons either passed through the Canal or was sent to the Far East, either as crude or finished products.

The refinery capacities of Aden, India, Australia and Japan apart from those dealing with indigenous crude, amount to about 33 million tons per year, and the major portion of these refineries are working on Middle East crude, so it is probable that deliveries of crude to these countries for the period under consideration amounted to about 16 million tons.

In addition, about 15 million tons of crude was refined in the Persian Gulf Refineries of Abadan, Ras Tanura and Bahrein, and it is probable that a large amount of the refined products were dispatched to the Far East, although no records regarding this are available.

It would therefore appear that about 40 million tons (1,650,000 b/d) of crude passed through the Canal in the first six months of 1956, when working conditions were normal; i.e. about half the Middle East production, and it is this half which will be greatly affected with a closure of this shipping highway, a large proportion of it being required to satisfy the needs of Western Europe.

The refining capacity of Western Europe including the United Kingdom is in the neighborhood of 125-130 million tons per year (2,500,000 to 2,600,000 b/d) and there is not nearly sufficient indigenous production to satisfy requirements, even if notable amounts are produced in Germany, Holland, France and to a certain extent Italy. Practically all the crude refined in Western Europe has been of Middle East origin during the past few years.

To carry on Western Europe's economy in face of a stoppage of supplies through the Suez Canal, would be one aspect of the situation, but to carry it on in the face of a call by Egypt to the Arab countries for a shut-down of oil production would be another. Both these situations are possible in view of the Arab temperament which places much more importance on the political or face saving side, than on the economic consequences of such actions.

The prosperity of the Middle East, arising from the development of its oil resources is of very recent growth, and this prosperity has so far been confined to a small percentage of the population. The effect of loss of prosperity to such a large extent would not be so widespread as it would in more advanced countries. The possibility, therefore of complete stoppage of production in the Arab countries although very remote can not be completely ruled out.

Partial stoppage by closure of the Canal and reduction of production by some of the Arab countries in sympathy with Ekypt is more probable. In this case it is a question of time, money and organization to remedy it, and after complete reorganization the cost of transporting Middle East crude to Europe would be little if any greater than the present cost, including Canal dues.

The modern tendency is to build larger and faster tankers, much larger than the supertankers at present in commission, some of which even now can not carry a full cargo of oil through the Canal. It would only be a question of time before sufficient tanker shipping could be built to carry the whole of the Persian Gulf production of crude oil via the Cape of Good Hope.

Even if the Canal is not closed, but remains in control of the Egyptian authorities, it remains to be seen if the present shipping capacity of the Canal could be improved or even maintained. For some years now the Canal Company has been working to increase the capacity of the Canal and also to make it navigable for the larger projected vessels to pass through. At the present time, vessels of a greater draft than 34'6" are not allowed to pass through except by special permission, and under special circumstances and even then the maximum draft is limited to 35'0".

Tanker News

London and Overseas Freighters Ltd. has ordered three new tankers to be built by Uddevallavarvet A/B, Uddevalla, Sweden, one of 19,000 dwt, one of 34,000 dwt and one of 40,300 dwt. Four new tankers have been ordered from the same shipyard by the new associated Bermuda Co., London and Overseas Tankers Ltd., i.e. two of 19,000 dwt and two of 34,000 dwt. This company is jointly owned by London & Overseas Freighters and a group of London financiers headed by Philip Hill, Higginson & Co. and has the advantage of light taxation under Bermudan laws.

Messrs. Vickers Armstrongs (Shipbuilders) Ltd. announce that the S.T. "Evgenia Niarchos" of 47,150 dwt built by them to the order of Neptune Tanker Corp. (a Niarchos Group Co.) was launched from their Barrow Shipyard on August 8, 1956.

It is the sister-ship to the "Spyros Niarchos," launched on December 2, 1955, these two ships being the largest tankers launched to date from British shipyards.

Her principal dimensions are: Length (overall) 757 feet; length (between perpendiculars) 725 feet; depth, 52 feet; discharge capacity, 4,000 water tons per hour; designed speed at 36 feet, molded draft—17 knots.

This is the last of a series of ten vessels ordered from Vickers-Armstrongs Ltd. by the Niarchos group, totalling over 300,000 dwt and costing over £13 million.

The S.S. "Alvenus" and tankship of some 32,000 dwt built at the Naval Yard, Walker by Vickers-Armstrongs (Shipbuilders) Ltd. to the order of the Alvion Steamship Corp., was successfully launched on August 2, 1956.

Her principal dimensions are: length overall, 663 feet; length between perpendiculars, 640 feet; depth (molded) 46 feet 3 inches; draft 34 feet; service speed 14.75 knots.

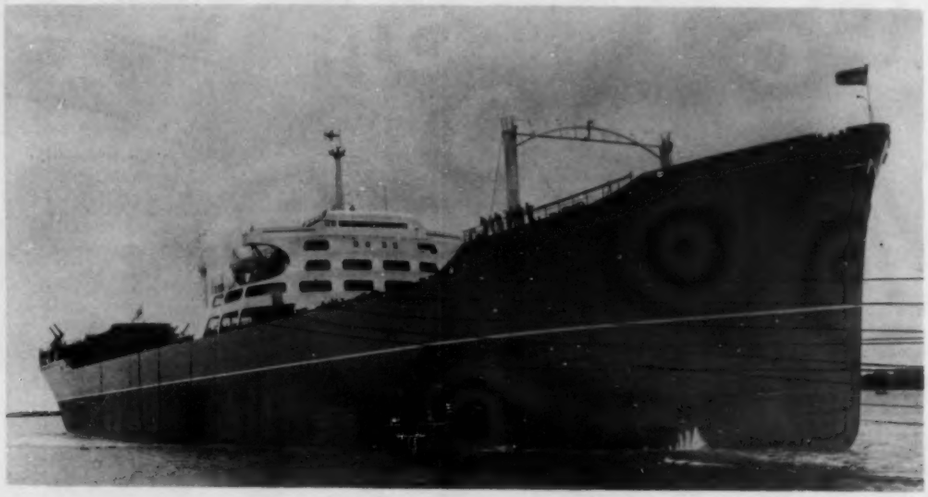
Mr. G. Ensor, a director, has been appointed to general manager of Fielden Electronics Ltd., of Wythenshawe, Manchester. Mr. Victor Thomas has been named general sales manager, responsible for all home and export sales and promotional activities.

New Chemical Plant at Fawley

Another new plant for the production of chemicals for petroleum is to be constructed by Monsanto Chemicals Ltd. on a 100-acre site close to the Fawley Refinery of Esso Petroleum Co., Ltd. from which the necessary feedstock will be drawn.

The first plant to be erected will be for the production of 10,000 tons of polythene per year, after which a major plant for the production of acrylonitrile is to be erected. Acrylonitrile is an essential raw material for certain synthetic polymers and fibres which has hitherto not been manufactured in the United Kingdom.

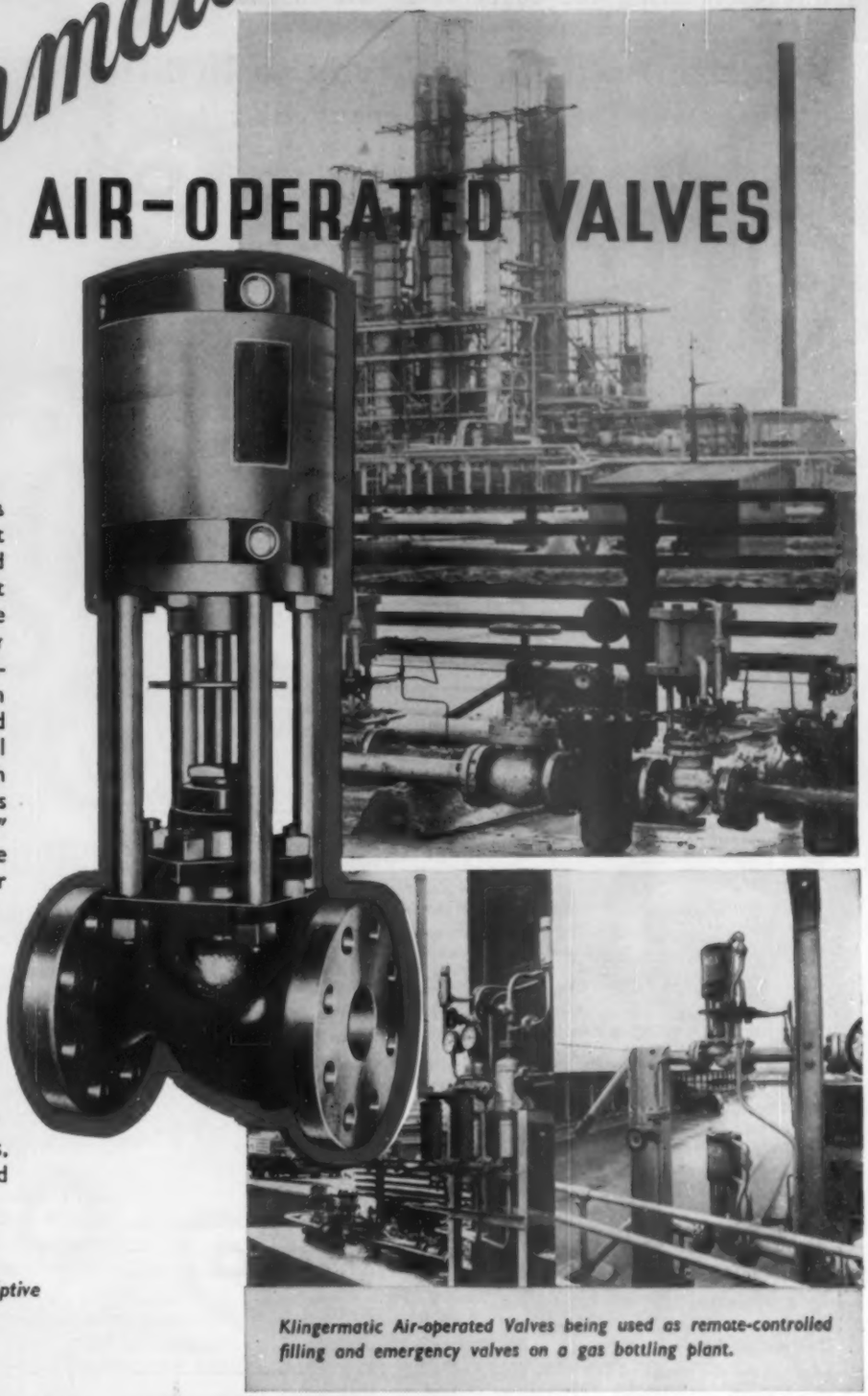
Survey work is being carried out on site, construction is due to start shortly and be completed in 1958. The estimated cost of these plants is £8.5 million.



"Evgenia Niarchos"

Klingermatic

AIR-OPERATED VALVES



The fact that the Klinger valve has no seat but is sealed by resilient packing rings which are compressed round a sliding piston, means that power is only required to move the piston from one position to another and no power is required to maintain the valve in the closed or open position. Valves are manufactured with bronze, forged or case steel bodies, screwed or flanged, with stainless steel pistons and spindles as standard, in sizes from ½" to 6" bore. Tapped air connections are provided at each end of the air cylinder. The valves have been designed for operation with an air supply at a pressure of about 70 p.s.i., although in certain circumstances it is possible for the valves to operate at pressures down to 50 p.s.i.

Klingermatic air-operated valves are ideally suited for remote control of filling lines, emergency valves, where rapid operation is desired and such similar applications.

Write to your Klinger agent for descriptive leaflets and literature.

Klingermatic Air-operated Valves being used as remote-controlled filling and emergency valves on a gas bottling plant.

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OTHERS PENDING

Hawthorne field service engineers are constantly providing that valuable *experienced service* intangible which money alone can't buy . . . continuing field demonstration of the right "Blue Demon" Bits, at the right time and place, for your specific equipment and local drilling conditions. It's offered day after day, on thousands of field service calls, at no additional service cost to you.

Covering more than 300,000 miles of exploration area per year, carrying a complete assortment of "Blue Demon" Bits for every equipment and drilling requirement, Hawthorne field service engineers can start you off right in any drilling area. By proper coordination of all tangible factors involved . . . weight of rig, drill string connection, size of pump, size of powder, gravel, sandstone, limestone, sticky shale or clay . . . you eliminate the cost of time-consuming trial and error.

Such coordination of bits to your specific requirements, right on the drill . . . available only from Hawthorne field service engineers . . . costs you nothing *unless* it's not used . . . and CAN save you plenty when measuring the costs of a hole.

The Hawthorne service men are not regularly available in international exploration areas, however, a wealth of Hawthorne bit experience is available to help you solve specific problems in foreign areas.

Fill in the form below and mail to Herb J. Hawthorne, Inc. for a detailed analysis of the drilling problems in your special area.

TYPES OF HOLES DRILLED:

☐ Oil Production ☐ Minerals Exploration ☐ Foundation Test Drilling
☐ Geological Exploration ☐ Diamond Core Drilling ☐ Water Well
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TYPES OF DRILLING: ☐ Water ☐ Air ☐ Auger

Diameter of common hole sizes drilled_____
Types of bits commonly used_____
Depth of holes drilled_____
Make and model of rig or drill_____
Size drill pipe_____ Name of thread_____
Size and make of pump_____
Size and make of compressor_____
Size and make of drill collars_____
General drilling area_____
Formations commonly drilled_____, _____
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Firm or Company_____ By_____
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Erratum

In an article in the March, 1956 issue of World Petroleum it was reported that the Jebel Fahud exploratory well had been spudded in at Longitude 55, Latitude 22 East. It now is reported that the correct location of the well is Longitude 56 deg. 30 min., Latitude 22 East.

Furfural Unit On Stream

The Texas Co. now has "on stream" in the first furfural refining unit in the world for the treatment of virgin gas oil cracking stock. The new furfural refining unit has a gas oil charge capacity of 25,000 b/d and gives a yield of about 94% reffinate, which is charged to a fluid catalytic cracking unit.

The furfural process, which developed and licensed through The Texas Co., has long been used for the refining of lubricating oils. However, the installation at Los Angeles Works is the first for the treatment of virgin gas oil.

Organizes Petrochemical Department

Universal Oil Products Co. has announced formation of a new department which will be responsible for the commercial application of petrochemical processes licensed by the company.

This new department will function under M. D. Gilchrist, process sales vice president, with H. W. Grote directing the group's activities.

Harry Clow Boardman

Harry Clow Boardman, director of research for Chicago Bridge & Iron Co., died on August 6th in Chicago.

Mr. Boardman was born in Plainfield, Illinois, on April 29th, 1887. Since 1954 he has been chairman of the Boiler and Pressure Vessel Code Committee of the American Society of Mechanical Engineers. He is a past president of the American Welding Society and past chairman of the Welding Research Council. He was active in many organizations, including the American Petroleum Institute.

New Iricon Head

John W. Gendron of Tidewater Oil Co. has been elected president of Iricon Agency Ltd., succeeding R. S. Stewart, vice president of the Standard Oil Co. (Ohio)

Iricon is the organization established to represent the five percent interest in the Iranian Consortium held by a group of oil companies including, American Independent Oil Co., Atlantic Refining Co., Getty Oil Co., Hancock Oil Co., Richfield Oil Corp., San Jacinto Petroleum Corp., and Signal Oil and Gas Co., Standard of Ohio and Tidewater.

Mr. Stewart now assumes a vice presidency of the agency after serving as its first president under an Iricon policy of rotating executive posts among officials of member companies. Our newly elected officers include L. C. Bergquist of Iricon's London office, vice president; David E. Day of Richfield, vice president; J. J. Shrewsbury of Hancock, treasurer; S. K. MacCauley of Atlantic, assistant treasurer; Raymond W. Ickes of American Independent Oil Co., assistant secretary. Benjamin Tyran of American Independent and John K. Schemmer of San Jacinto were elected to the Iricon board of directors.

Sales Representative Appointed

Rawson & Co. have been appointed sales representatives for the Schuyler Manufacturing Corp. with headquarters at 1223 Waugh Drive, Houston. They will handle sales and service for Schuyler's petroleum and chemical equipment, including Schuyler-nit Entrainment Separators (mist eliminators).

SEG Annual Meeting

The Southeastern Geophysical Society is host for the Twenty-Sixth annual meeting of the Society of Exploration Geophysicists which will be held in New Orleans, October 29 through November 1, 1956. All technical sessions will be held in the Roosevelt Hotel, the headquarters hotel for the meeting. The technical program will open Monday afternoon and the formal technical program will run through Thursday afternoon. There will be no night sessions so that the charms of "old New Orleans" can be enjoyed by all.

Another Westinghouse Gas Turbine goes on the line

Looking for an easy-to-install prime mover? Or a reliable source of electric power?

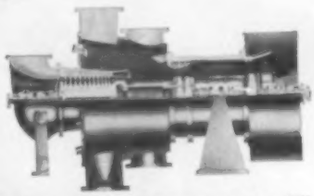
In either case you'll find what you need in the new Westinghouse gas turbine. This surprisingly flexible power plant comes in capacities from 1800 hp (1250 kw) to 20,000 hp (15,000 kw). It works on gaseous or distillate liquid fuels, and requires little or no water . . . making it particularly ideal in areas where water is short or gas is plentiful. And its light weight plus vibration-free operation minimize the expense of supporting foundations.

You're in good company when you specify Westinghouse gas turbines for uses such as compressor drive, pipeline pumping, mobile, emergency, or normal power supply. The Mene Grande Oil Company, for example, uses these units . . . one of which is illustrated during installation . . . to convert natural gas into electric power for their eastern Venezuela oil fields. And Creole Petroleum Corporation is harnessing 12 Westinghouse gas turbines to pump natural gas into oil deposits below Lake Maracaibo. This operation forces the oil upwards, enabling Creole to recover substantially more of the "black gold" than with more conventional methods.

If you want more power quickly, find out the facts about Westinghouse gas turbines. Write for free booklets: B-5887 for electric power generation; B-5859 for mechanical drives.

N. F. Emig

N. F. Emig, *Supervisor*
Steam Section



Cutaway view of Westinghouse 5000-hp gas turbine. Red area shows path of hot gases from combustion chamber (L.) through power turbine to exhaust (R.). View highlights simple, compact design of turbine.

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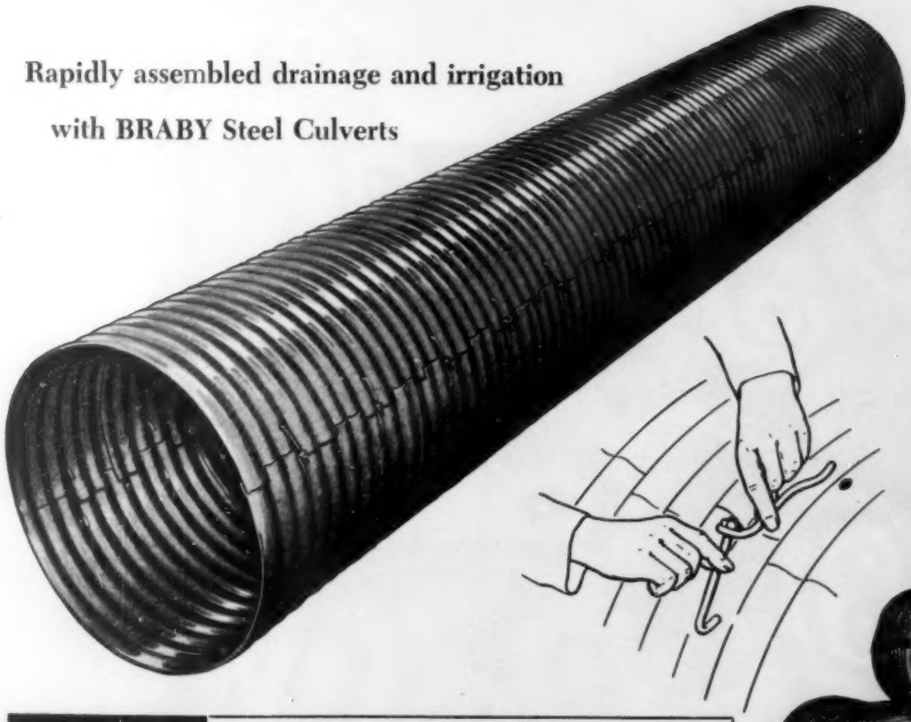

These galvanized corrugated steel culverts are manufactured in standard diameters from 12in. upwards and in thicknesses from 18 g. to 10 g. The Units designed for economical shipment, are easily and securely fitted together on the site. A leaflet with details and instructions will be forwarded on request.

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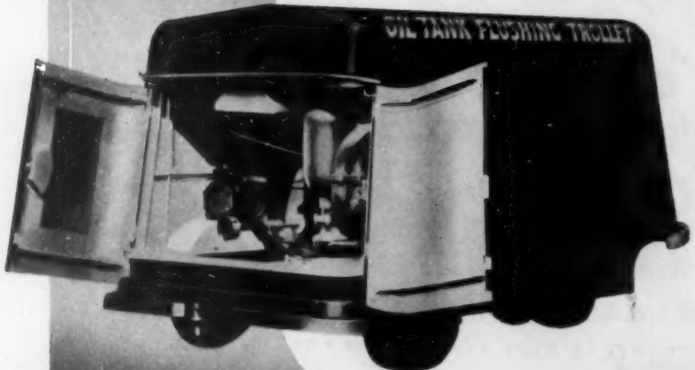

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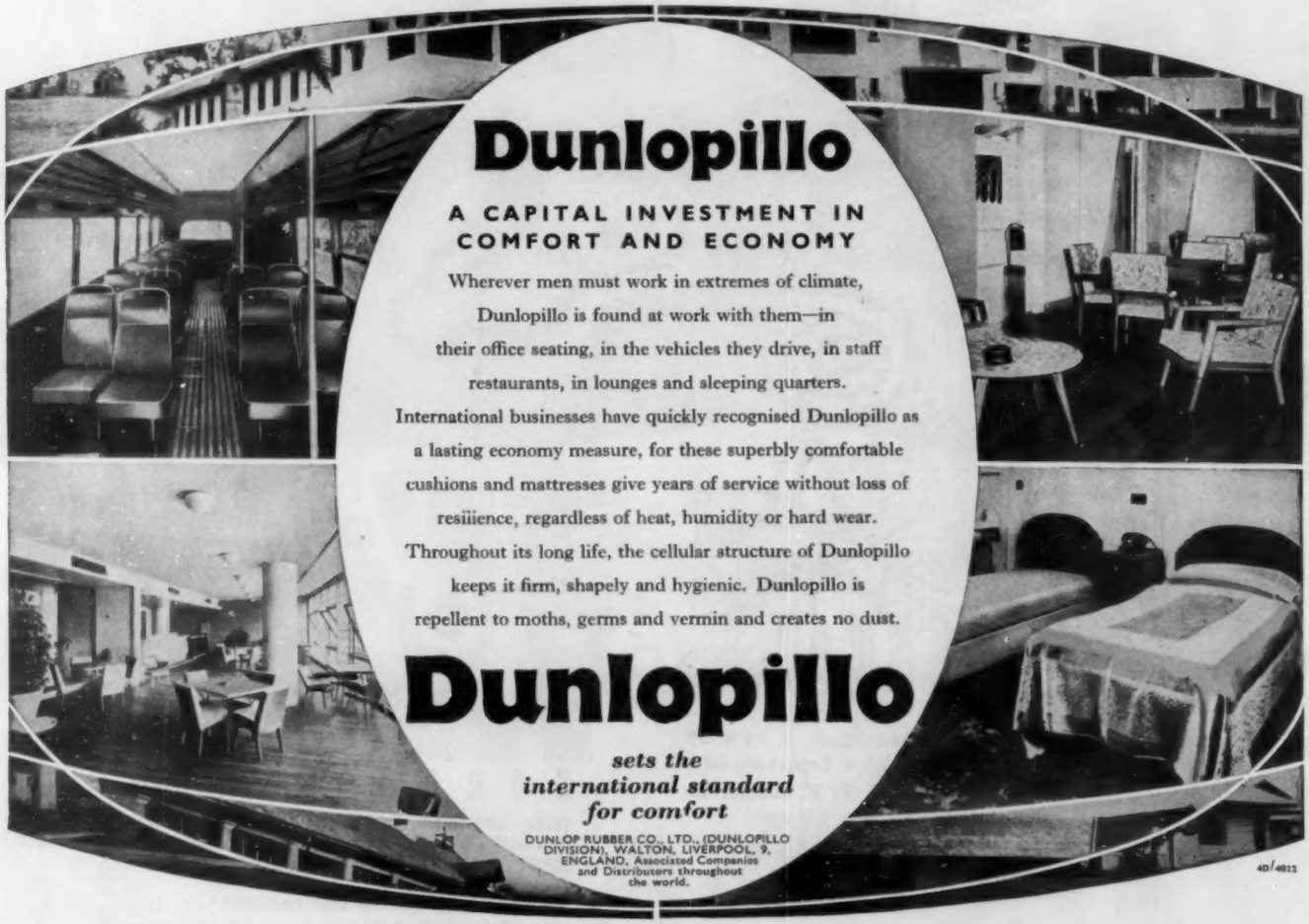

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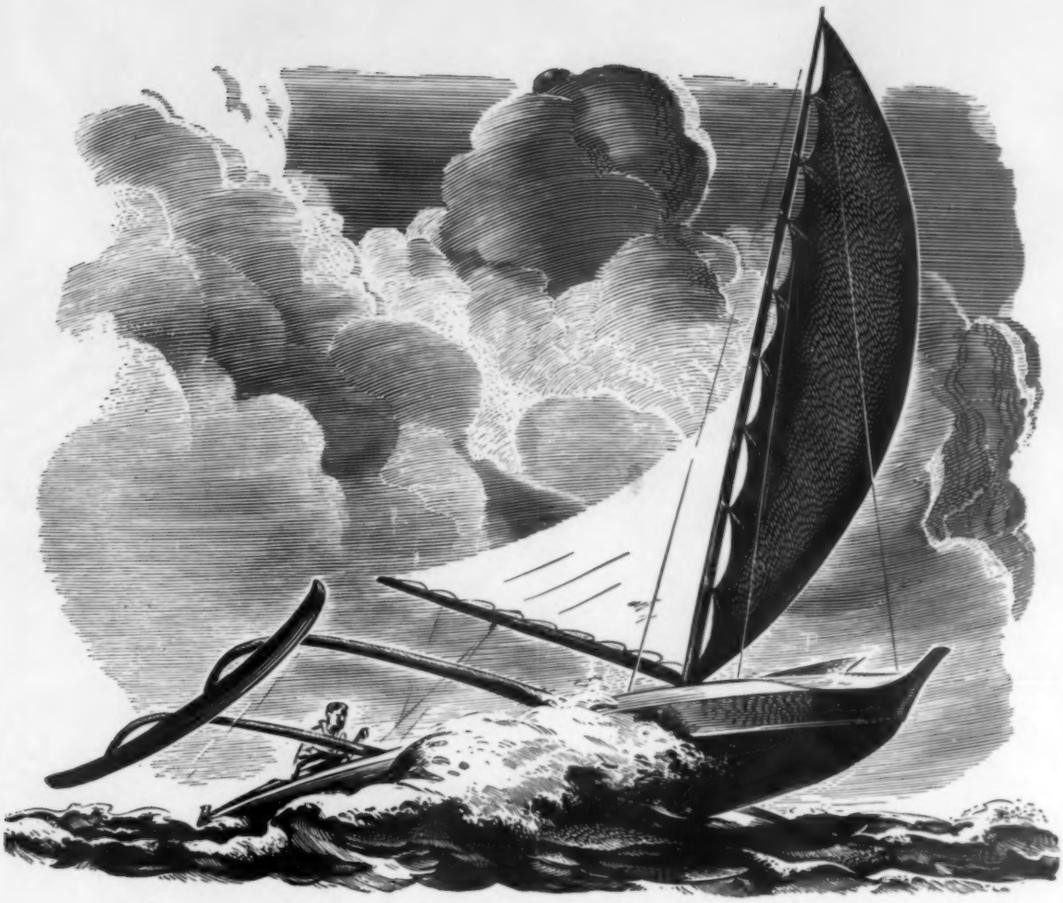

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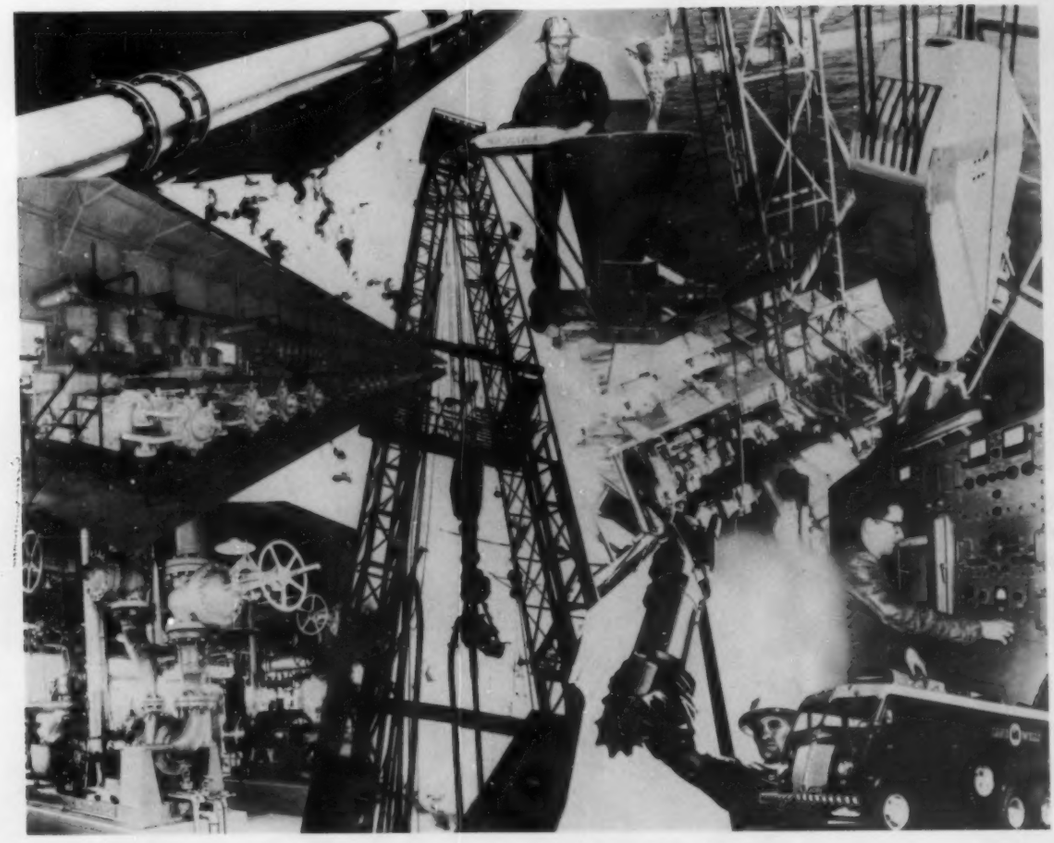

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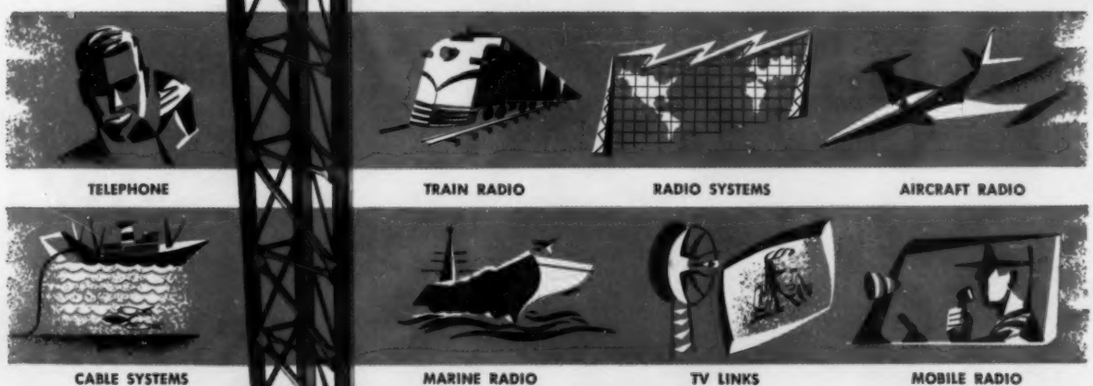

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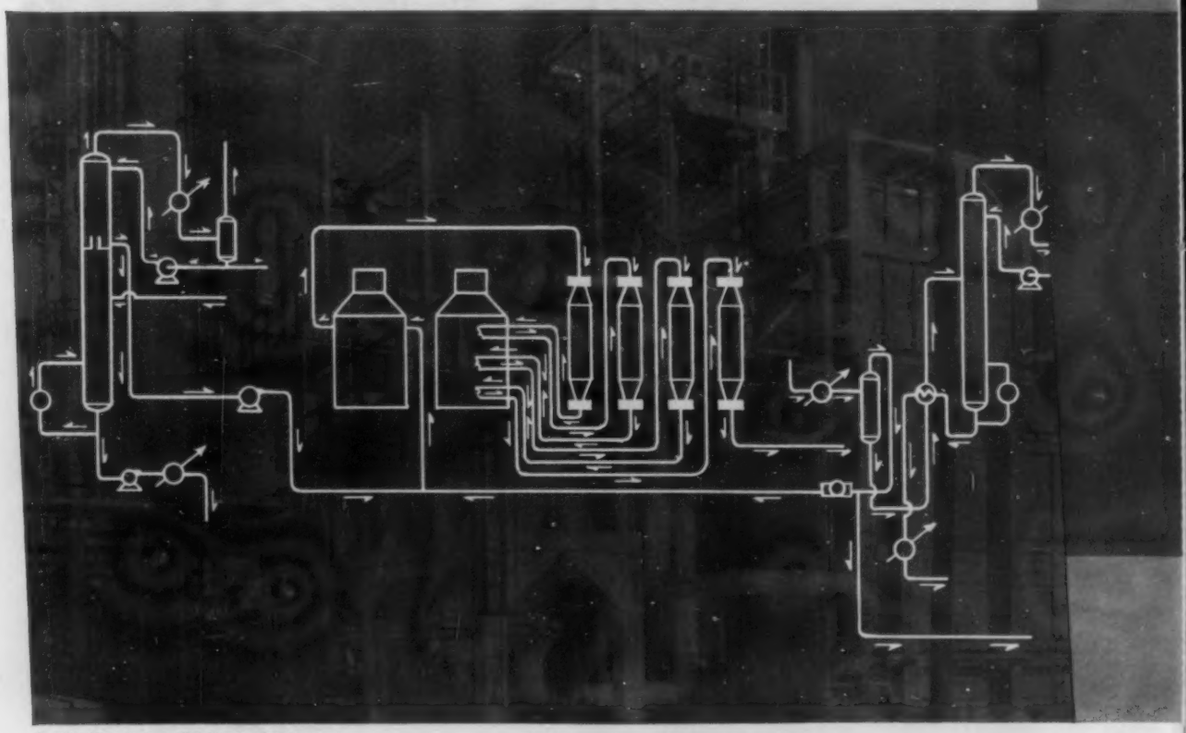
TO GET THE MOST OUT OF

THIS IS THE GOAL OF EVERY REFINER AND HERE IS HOW UOP RESEARCH IS HELPING ATTAIN IT....

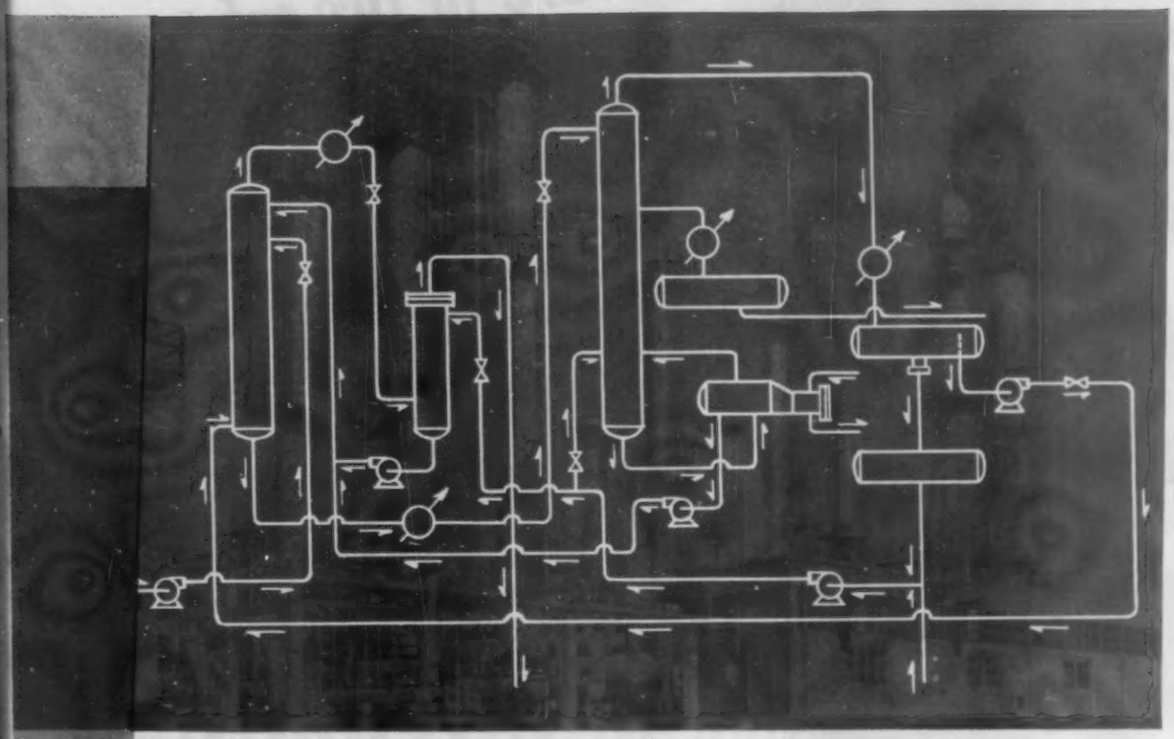
For more than forty years Universal has been developing improved petroleum refining processes, to help refiners fulfill the nation's need for motor fuels. Beyond this primary objective, UOP research has always considered the broader problem of helping the refiner get the maximum return from every barrel of oil he processes. One of our developments in petrochemicals is striking evidence of this.



Simplified flow diagram of Platforming Process

Platforming, developed by UOP and introduced in 1949, pioneered the use of platinum in a catalyst for refining gasoline and is today one of the world's most widely used processes. Early in its development, our research team realized that Platforming offered a practical means of helping meet the chemical industry's growing demand for aromatics. Experimentation indicated that, by employing certain modifications in operating conditions, high yields of aromatics were possible through Platforming. This was only a partial solution because the problem of separation of aromatics in the degree of purity required by the chemical industry still remained.

Every Barrel OF CRUDE



Simplified flow diagram of Udex Process

Udex, developed by Universal in cooperation with Dow Chemical Company, provided the answer. It successfully created and applied the separation equipment necessary to concentrate the aromatic hydrocarbons produced by Platforming into the form required by the chemical industry. This combination of UOP's Platforming and Udex processes, an outcome of a basic research program originally directed toward motor fuels, is an outstanding example of the broad scope of UOP research.

Universal research is continuing to develop and make available to all refiners, everywhere, not only new and improved processes for producing more efficient fuels for automotive engines, but also better ways of utilizing by-products from petroleum. In this way we believe we are truly helping the refiner to get the most out of every barrel of crude.

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In the world's largest refineries, in tank farms and dock installations, in every branch of the Oil industry, 'Pyrene' Fire Fighting Equipment utilising Foam and every other tried and proved medium, safeguards property, stock, plant and human life from the ravages of fire.

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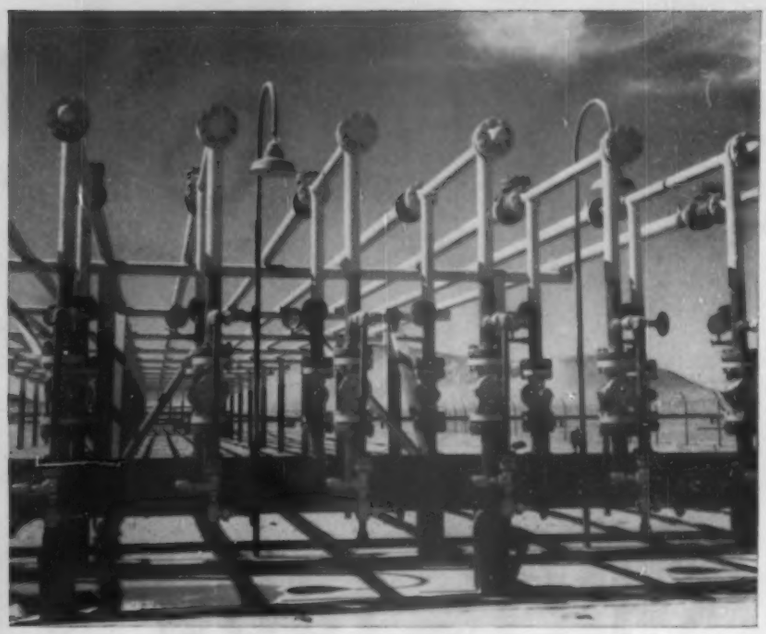
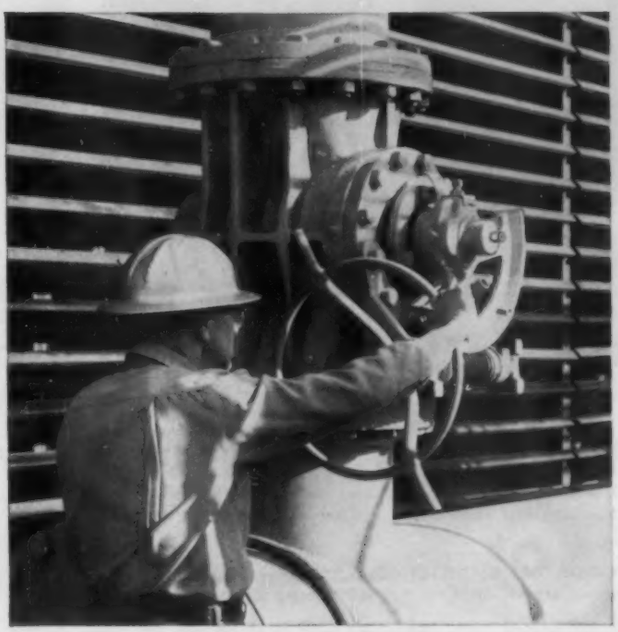
Out in the production fields...





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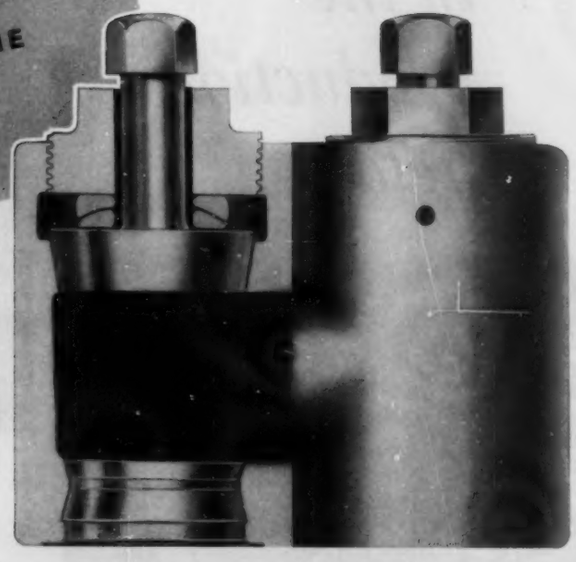

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FOUR SERIES
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1. **STRENGTH OF CLOSURE DESIGN:** Uniform stress in tension and shear about holding mechanism and body casting at all times. The floating set collar eliminates thread galling and/or thread seizure, thus ensuring easy removal. Convex and concave surfaces of the equalizing rings ensure proper alignment between set collar and plug.

2. **NO DISTORTION OF SET COLLAR:** Bending of set collar is prevented as a result of the full 360° bearing with threaded top of fitting.

3. **SELF CONTAINED CLOSURE MECHANISM:** All the closure parts handle as one unit when heading-up or unheading.

4. **SIMPLE & RAPID UNHEADING:** A positive plug puller device is incorporated in the closure mechanism. No pulling tools are required —one wrench backing off the set collar will also serve as plug puller. The set collar is backed off until it becomes engaged with the nut on the plug stem. Additional turn of the set collar forces release of the plug while the threads are still engaged.

5. **SAFETY FEATURE:** The plug cannot blow out. Trapped gases can escape through weep-holes while the set collar is still engaged in fitting.

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Standard's new radiation-resistant lubricants are helping put atomic power to work

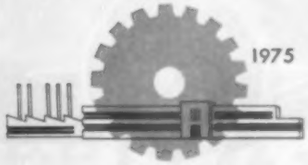
During exposure to atomic radiation, some petroleum oils are turned into solids, hard enough to drive a nail, useless as a lubricant

BY 1975 the world will use nearly twice as much energy as it does today—and atomic power will be needed to supply part of the growing demand. Helping develop this new power, Standard research teams have been working with the Atomic Energy Commission on many projects during the past 10 years.

One of our most urgent problems was to find lubricants for atomic machinery able to withstand withering radiation. Using a brand-new base derived from petroleum, Standard scientists developed oils that last two to three times longer than conventional lubricants—and speed the day when commercial atomic power will help drive planes and ships, and generate electricity for your home.

Progress in the West means...

atomic energy will be needed to help meet 1975 power demands of nearly twice those of 1956



STANDARD OIL COMPANY OF CALIFORNIA

puts petroleum progress to work for you

Socony Earnings Up in 1956

Earnings of Socony Mobil Oil Co. for the first six months of 1956 are estimated at $181 million before United States and foreign income taxes and at $124 million after those taxes, on the basis of world-wide consolidation of accounts effective January 1. This compared with net earnings for the first six months of 1955 of $100 million.

Texaco Net Up 10.5% in 1956

Estimated net earnings for The Texas Co. and its subsidiaries for the first six months of 1956 amounted to $138,088,709 or $2.52 per share, up 10.57% over the like period in 1955. Net earnings for the first half of 1956 included dividends received from domestic and foreign non-subsidiary companies totaling $49,625,133. Comparable dividends for the first half of 1955 totaled $41,443,309.

Esso Export Changes

Esso Export Corp., international sales affiliate of Standard Oil Co. (N.J.), announced today the following executive changes in its treasurer's department:

A. C. Hamilton, former European financial advisor has returned to the United States as assistant treasurer and has been replaced by N. T. Saltnes of the New York office. R. T. Bonn, formerly senior financial analyst with Standard Oil Co. (N.J.), will become an assistant treasurer in the New York office.

Named Industrial Relations Director

John Sukup has been named industrial relations director for Security Engineering Division at Dallas, one of the Dresser Industries. He also will head industrial relations for Security's Whittier, California plant and other Security installations.

ITCO and Bowen Merge

Two Houston firms—Bowen Co. of Texas, Inc., and ITCO International, Inc. have merged and are now known as BOWEN-ITCO.

The two companies had been associated, with the Bowen Co. of Texas manufacturing Bowen and ITCO tools and distributing these products in domestic trade, and ITCO International marketing ITCO and other product lines in export. Announcing the merger and new identity, Dean W. Osmun, spokesman for BOWEN-ITCO, explained that the new organization will be "in a better position to serve all our customers, particularly in the export market." A considerable expansion of the company's export activity is anticipated, according to Mr. Osmun.

LeTourneau Builds Second Platform

R. G. LeTourneau, Inc., will build a $3¼-million offshore drilling platform for Zapata Off-Shore Co. of Houston, with delivery scheduled for early 1957. The eight million pound platform will be triangular in shape and will be raised and lowered on three 145-foot open-truss legs. Legs are raised and lowered by electric motors geared to vertical gear racks.

At the base of each leg will be a 32 by 35 foot tank, which will serve as "feet" for the platform. The bottoms will be cup-shaped to better grip the ocean's floor. Also there will be facilities to force jet streams of water into these cup-shaped areas to help free the "feet" from mud and sand after a well is completed.

The deck will be 194 feet long and 152 feet wide, or well over half an acre in area. Located here will be housing accommodations for a 45-man crew, areas for storing drill pipe and other supplies, two deck-mounted LeTourneau revolving cranes with 300-foot-ton capacities and 80-foot booms, and three LeTourneau anchor windlasses.

Powering the electric elevating system, and also supplying ships service power for the platform, will be LeTourneau-built generators driven by three 600-horsepower diesel engines. A separate set of engines will furnish power for mud pumps, drawworks and other drilling machinery.

Interior of the 20-foot-deep hull will house much of the drilling equipment as well as the diesel engines, generators, and various supplies. Compartments have been designed to hold 1,000 barrels of drinkable water, 5,000 barrels of drilling water, 1,000 barrels of diesel oil, 1,500 barrels of active drilling mud, and 10,000 sacks of dry drilling mud.

Fully loaded, the 4,000-ton drilling platform will have a draft of only 11½ feet.

C. H. Elliott *J. A. Grundy* *H. B. Book*

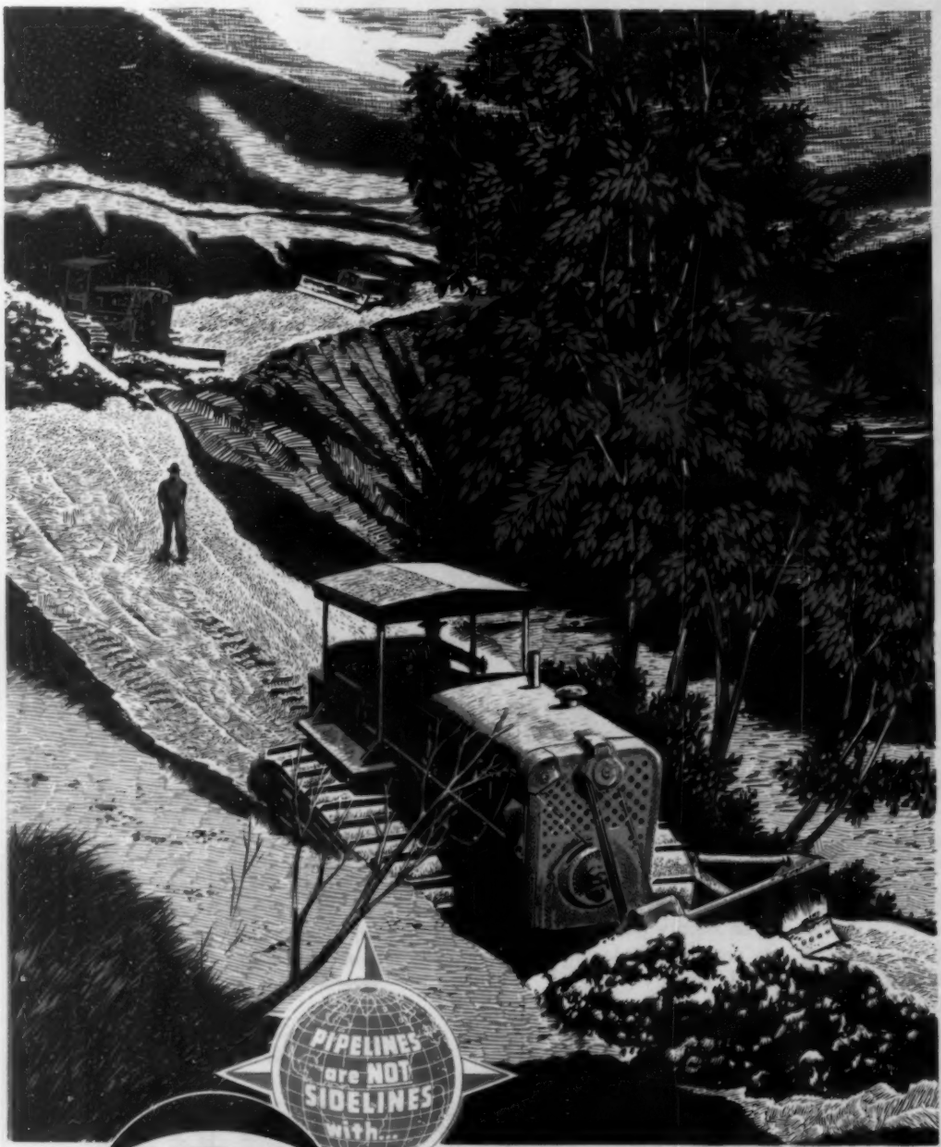
Promotions at Reed Roller Bit

Reed Roller Bit Co. has announced promotion of three men to vice presidencies for the oil tool division, H. B. Book, former export sales division manager, was named vice president, sales. J. A. Grundy, former factory manager, was named vice president, manufacturing. C. H. Elliott, former manager of the cleco air tool divisicn, was named vice president of that division.

Mr. Book has been with the oil tool division since 1928. He became export sales division manager in 1940. Under Mr. Book's management, export sales volume has grown to be a large percentage of Reed oil tool sales.

Mr. Grundy has been with Reed since 1937. He has had the responsibility for major plant expansions and tooling modernization programs, resulting in greatly increased production and efficiency.

Mr. Elliott came to Reed in 1940 and was made manager of the cleco air tool division in 1950.



Now under construction: West Coast Transmission Line

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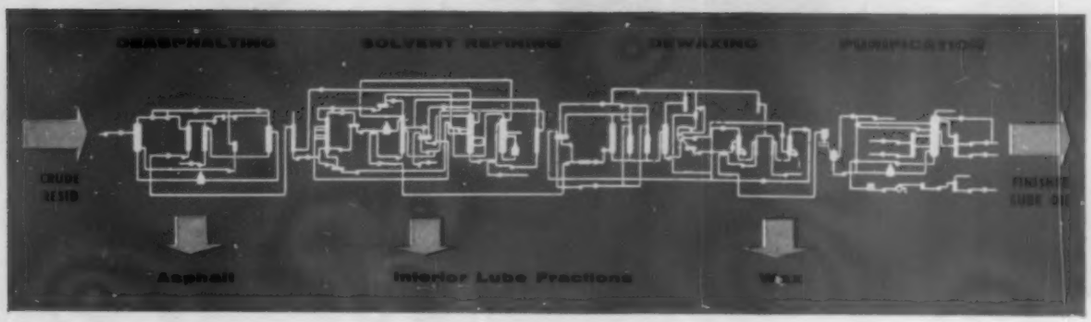

Foster Wheeler experience points the way to lower cost production

Complete lube oil plant, designed and constructed by Foster Wheeler at England's largest refinery. Process units, in sequence from right to left, are as follows: propane deasphalting, phenol extraction, propane dewaxing and clay contact-vacuum rerun. Foster Wheeler is now building complete lube plants in the United States, Iraq and Venezuela.

NEW ADVANCES in refining processes and equipment have resulted in substantial increases in the overall efficiency of lubricating oil production—contributing to higher sustained output of high quality oils at lower unit production cost.

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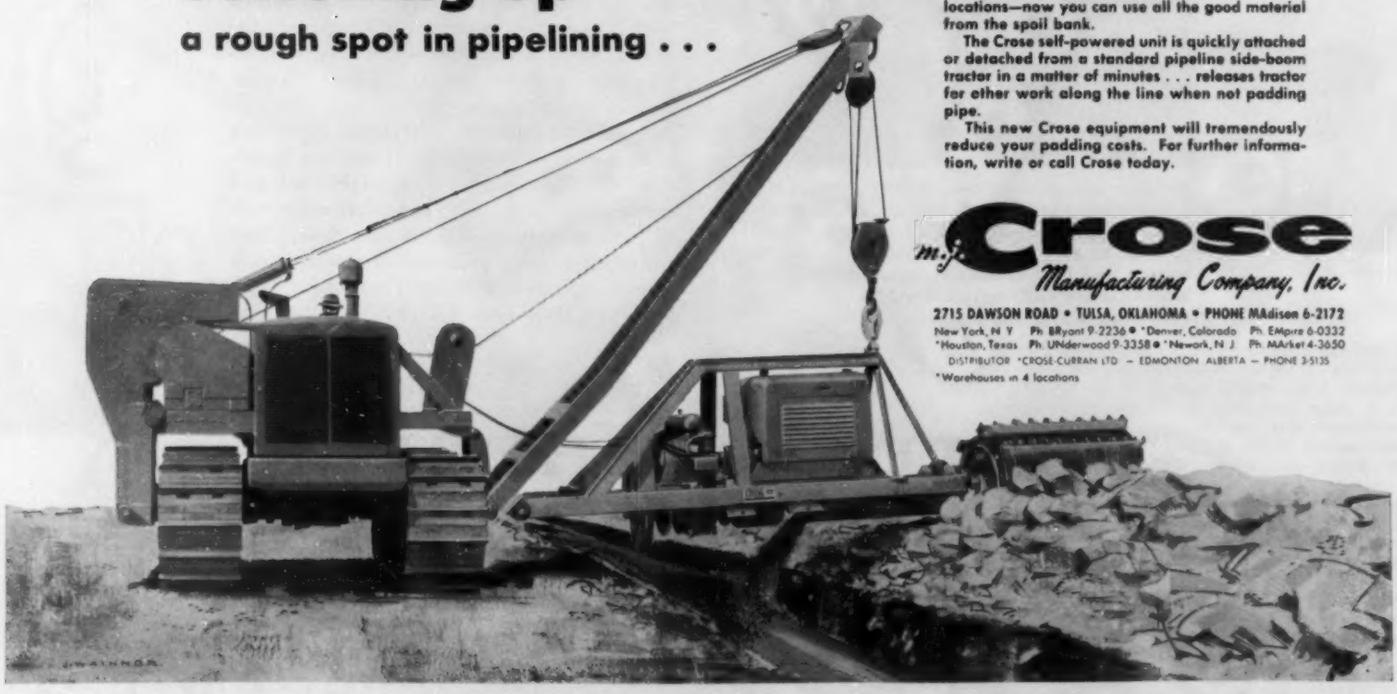

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When their father died, the brothers were embarrassed to find that the property consisted of seventeen camels. However, a friend of their father helped them to solve the problem by lending them yet another camel, with the result that Ibrahim now owns nine healthy camels, Abdul is very proud of his six, and little Omar cannot decide which of his two he likes the better.
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International News and Notes

Kuwait & Neutral Zone Exports

Kuwait crude oil exports came to 35,796,501 barrels in May and 175,143,463 in the first five months of the year. Distillate exports were 103,908 barrels in May and 412,726 in the first five months.

Crude exports from the Neutral Zone by Aminoil came to 180,682 barrels in May and 2,336,356 in the first five months. Getty Oil Co. crude oil exports came to 467,920 in May and 2,089,666 in the first five months.

Ecuadorian Oil Production, Refining Up in 1955

Company-by-company statistics on crude oil production, natural gasoline output and refinery production in Ecuador are set forth in recent U. S. government reports covering 1955. Slight increases over the previous year are shown.

The 1955 figures (in U. S. gallons) are as follows.

Oil Operations In Ecuador—1955

Production	
Anglo-Ecuadorian Oilfields Ltd., Guayas Province:	
Crude oil	105,321,594
Natural gasoline	6,527,266
	111,848,860
Refinery Production	57,973,043
Manabi Exploration Co., Cautivo, Guayas Province:	
Crude oil	24,570,578
Natural gasoline	437,496
	25,008,074
Refinery Production	7,677,002
Carolina Oil Co., La Cardina, Guayas Province:	
Crude oil	16,610,664
Natural gasoline Since Aug. 1955	368,727
	16,979,391
Refinery Production	15,861,881
Concepcion Ecuadorian Oilfield Ltd., Concepcion, Guayas Province:	
Crude oil	2,237,298
Petropolis Oil Co., Petropolis, Guayas Province:	
Crude oil	2,415,966
Refinery Production (for account of Anglo-Ecuadorian)	2,210,318
Totals: Crude oil	151,156,100
Natural gasoline	7,333,589
Refinery Production by Product—1955	
Gasoline	27,691,578
Kerosine	8,258,981
Diesel oil	14,295,332
Residual	32,526,359
Jet fuel	572,645
Lube oils—light	190,754
Lube oils—heavy	79,765
Asphalt	106,830
	83,722,244
Greases	19,391
Exports—Crude oil	64,139,874
Imports—Products	30,871,639

1955 well drilling is as follows:

	Exploitation	*Exploration*
Anglo-Ecuadorian	140	19
Manabi	36	—
Carolina	9	1
Concepcion	3	—
	188	20

During the year which opened April 1, 1956, plans of Anglo-Ecuadorian call for well drilling as follows:—Deep exploration wells, 1; deep exploitation wells, 1; exploration wells, 4; shallow exploitation wells, 94.

Carolina plans six exploitation wells in the year.

Oil Use in Spain Increasing

The movement of oil in Spanish international trade reflects rising Spanish consumption. Spanish government figures are as follows (in metric tons):

SPANISH PETROLEUM TRADE

	IMPORTS 1954	1955	% Change	*EXPORTS* 1954	1955	% Change
Gasoline	121,346	65,218	—46.4	51,359	70,821	+52.3
Kerosine	42,981	66,145	+53.9	24,938	24,363	— 2.3
Diesel	1,029,448	408,094	—60.4	1,150,302	704,872	—38.7
Lubes	75,590	71,819	— 5.	354	341	—
Crude	2,590,668	2,785,948	+ 7.5	1,171	—	—
Fuel oil	936,068	694,498	—25.8	867,624	242,398	—72
Asphalt	4,855	3,400	—30.	360	308	14.5
Vaseline	630	1,110	+73.4	—	—	—
Paraffin	1,770	1,541	—12.9	—	—	—

New Oil Strike In Iran

National Iranian Oil Co. has made a major discovery in the Qum area about 100 miles south of Teheran in its Aborz No. 5. The well went out of control when high pressure gas and large volumes of oil were encountered at an undisclosed depth, reportedly about 8,000 feet.

Myron Kinly was summoned from the United States to supervise capping operations and on arrival indicated that at least ten days would be required to get the well under control. Meanwhile, the oil flow has been estimated variously from as low as 30,000 b/d to as high as 150,000 b/d. General concensus among oil men who have visited the well is that the flow is on the order of 50,000 b/d. The oil is of fine quality and tests 41 API gravity. Fortunately, there has been no fire at the well. A vast lake of oil has collected near the bore-hole.

The well is not far from the products line being laid from Abadan to Teheran but otherwise is isolated. It is far from any refinery or other market outlet. Additional drilling will be undertaken to determine the extent of the new field.

Sicily Production Up To 10,000 B/D

Gulf Italiana is running two development rigs in the Ragusa field in Italy and drilling two wildcats in other parts of the island. In Ragusa wells Nos. 15 and 16 are now drilling. Of the previous 14 wells drilled, 13 have been producers. The one dry hole was of the fault to exact location of which was previously not known. Drilling to date has proved an area of about 2,800 acres.

Ten wells currently are pumping an average of 10,000 b/d of 16 gravity oil. There is not enough formation pressure to lift the oil. Current production is being moved from the field by tank car and tank truck. Much of the production is being processed at the nearby RAISOM refinery at Augusta, Sicily. The oil is valued because of the current surplus of light products in European markets and the heavy demand for fuel oil.

Gulf is laying 45 miles of 14 inch pipe line from the field to the refinery and to a proposed marine terminal. Tentative site for the terminal is on the peninsula at Magniai. Completion of the line should permit an increase in production as the field is enlarged.

West of Ragusa at Gela on the coast, AGIP has a showing in a wildcat currently drilled below 10,000 feet. Drillstem tests have suggested that a commercial well may be in prospect.

North of Ragusa Gulf and associates are drilling a test at Aranella and are moving in a rig to a location at Capizzi. The location is in a mountainous area so that 10 kilometers of road must be built to the drillsite. A core drilling rig is operating at Platani. All of these operations are on exploration permits. The only completed concession is that obtained by Gulf at Ragusa.

On the mainland of Italy Gulf has announced that it will withdraw if the presently proposed oil law is finally adopted. It has been passed by the assembly but not yet approved by the Senate. Gulf has pointed out that the proposed new law is restrictive in its provisions and requires the payment of too great a share of the oil reserves to the nation. Gulf and Montacatini drilled what appeared to be a good discovery on the mainland in its Cigno No. 1. The well soon went to water, however, the water was fresh, not salt. Signo No. 2 was dry.

Refinery Runs Down in Uruguay

Crude runs to stills in the first quarter of 1956 were 1,948,000 barrels (21,406 b/d), down slightly from the level of 23,400 b/d in 1955. Figures on runs in the 1st quarter of 1956 at the Administration Nacional de Combustibles Alcohol y Portland (ANCAP) are as follows (in barrels).

Runs to Stills in Uruguay—1955	
Aviation gasoline	3,717
Motor fuel	515,000
Kerosine	200,000
Gas oil	217,000
Diesel oil	101,000
Fuel oil	850,000
Lube oils	—
Other	33,000
Losses	29,000
Total runs to stills	1,948,717

Crude imports during the 1st quarter of 1955 were 1,437,000 barrels, received as follows (in barrels): Saudi Arabia, 122,000; Colombia, 149,000; Venezuela, 1,166,000.

Italy's Third Platformer

The third of seven UOP Platforming units contracted for in Italy has gone into operation at the local refinery of Societa CONDOR Per l'Industria Petrolifera e Chimica. The unit was designed and licensed by Universal Oil Products Co. and engineered and erected by Compagnia Technica Petroli CTIP of Rome, Italy, engineering contracts. The equipment was made and erected by Italian firms.

Pipe Line Completion Due in Iran

The 337-mile products line from Ahwaz in the Consortium's area to Teheran will be completed this year. Costain-John Brown, Ltd. of London is building the line, Williams Brothers Co. is assisting in an advisory capacity. Charles P. Williams, vice president, and C. M. Collins, chief engineer, of Williams Brothers will visit and inspect the line.

Israel Enacts Depletion Allowance for Oil Income

Foreign and domestic oil operators in Israel now receive a retroactive depletion allowance. The new regulations, which were promulgated July 29 in Jerusalem, give oil operators a "percentage depletion" equal to 27½% of their gross income from crude oil and natural gas production, as long as this figure does not exceed half the net income for a taxable year. Companies may also deduct "cost depletion," an amount based on actual investment in oil and gas rights, should this amount be more than the percentage depletion.

Super-Tanker Building in Japan

Construction of super-tankers has become a new specialty of Japanese shipbuilders. In the recent few months, four super-tankers were either launched or completed at key dockyards. The first was 41,400 dwt tanker Andros Castle, built by Mitsubishi Nippon Heavy Industries for the Orion Shipping & Trading Co. of New York. The second was the Tsubame Maru, a 33,500 dwt tanker constructed at the Kobe Dockyards of New Mitsubishi Heavy Industries, Ltd. The 20,750 dwt Borneo Maru was built by Hitachi Shipbuilding, Ltd. for Nippon Oil Tanker Co. The Ryuei Maru, 32, 800 dead-weight tons, built by Mitsubishi Dockyards at Nagasaki was the first diesel-powered tanker ever constructed in Japan. The Ministry of Transportation recently permitted National Bulk Carrier, Ltd. (U.S.) with dockyards at Kure to start construction of two mammoth tankers, both 87,000 dwt for Liberia Universe Tankship Co. The two giant tankers, equipped with a 19,250 hp turbine each, will be completed in October, 1957 and March, 1958, respectively.

Rationing Plan

(*Continued from page* 45)

is said to agree that as much as a third can be converted to foreign currency and sent home. Paid leaves and other inducements are offered.

Any mass change in pilot personnel doubtless would have an effect on the efficiency of the canal and cause some tie-ups. This would not, of course, cut off Europe's oil supply.

There are some in Europe who hold the view that the industry should proceed at once to prepare for eventual abandonment of Suez as an oil artery. A rumor was published that a big-inch pipe line would be laid from Kuwait to the Mediterranean through Iraq and Turkey. This would be a revival of an earlier proposal, with some modifications. This project is not under consideration according to statements to World Petroleum by responsible officials of companies concerned.

Work on Iraq Petroleum Company's new 450,000 b/d to the Mediterranean is being retarded now because of failure of the company to reach an agreement with either Syria or Lebanon. In any case, completion is not expected before the end of next year. Should the rumored Kuwait-Turkey line actually be undertaken at some later date, it would not have any effect for some years to come.

Some elements in the European petroleum industry suggest that the super-tanker building program be stepped up at once in all available yards as being the best long-term solution of market supply. With an enlarged fleet of huge modern tankers they feel that the industry would be in far better position to free itself from any sort of squeeze either by high tolls, mismanagement, or artificial interference with the free flow of commerce through Suez or by pipe line through Arab non-producing countries.

In any case, while the politicians are conferring the oil industry is preparing its plans to shift sources of supply and intercontinental flow routes if that becomes necessary. The industry never has been more flexible than at present. Canada, the United States and Venezuela all have substantial excess producing capacity which can be utilized if necessary. Elimination of cross hauls and other devices doubtless would minimize European rationing to a surprising degree. END

Slip Type Mooring Hook

A mooring slip hook of new design has been patented by the Monarch Controller Co., Ltd., London. The hook is designed to be slipped from the moored vessel without the assistance of any shore staff. This can be accomplished intantly in case of fire or where a ship is moored to a buoy at the onset of a severe storm. The quick release feature has special advantages for oil tankers.

Mounted between massive steel side plates, the mooring hook is pivoted on a stout bearing secured by side nuts fitted with split pins. The hook is provided with a tail, which is locked in the operative position by a pivoted latch.

The latch is locked in position by a lever mounted on a pivot bearing, fitted with spring washers, between the frames.

The lever is provided with a counterweight and has one long arm, to which a release rope can be attached, and also a shorter arm. On pulling the release rope the lever is moved forward and the lower, or short arm, engages with a projection on the pivoted latch. The latch is therefore turned on its pivot and its upper end disengages from the tail of the hook, which is thereupon moved into the open position and the mooring rope is released.

The device can be fitted on any existing bollard or ground moorings and it can if required, be used in conjunction with the company's patent shock absorber. An accompanying photograph shows a combination slip hook and shock absorber.

Southern Production Earnings Up Slightly

Net earnings of Southern Production Co., Inc., for the first half of 1956 amounted to $2,334,855, equal to $1.34 per share, a small increase over the first six months of 1955.

New Plant for Electro-Tech

Electro-Technical Labs, Houston, is building a new $335,000 headquarters and plant at Glenmont and Sixth streets near Bellaire. Present plant is at 504-512 Waugh Drive.

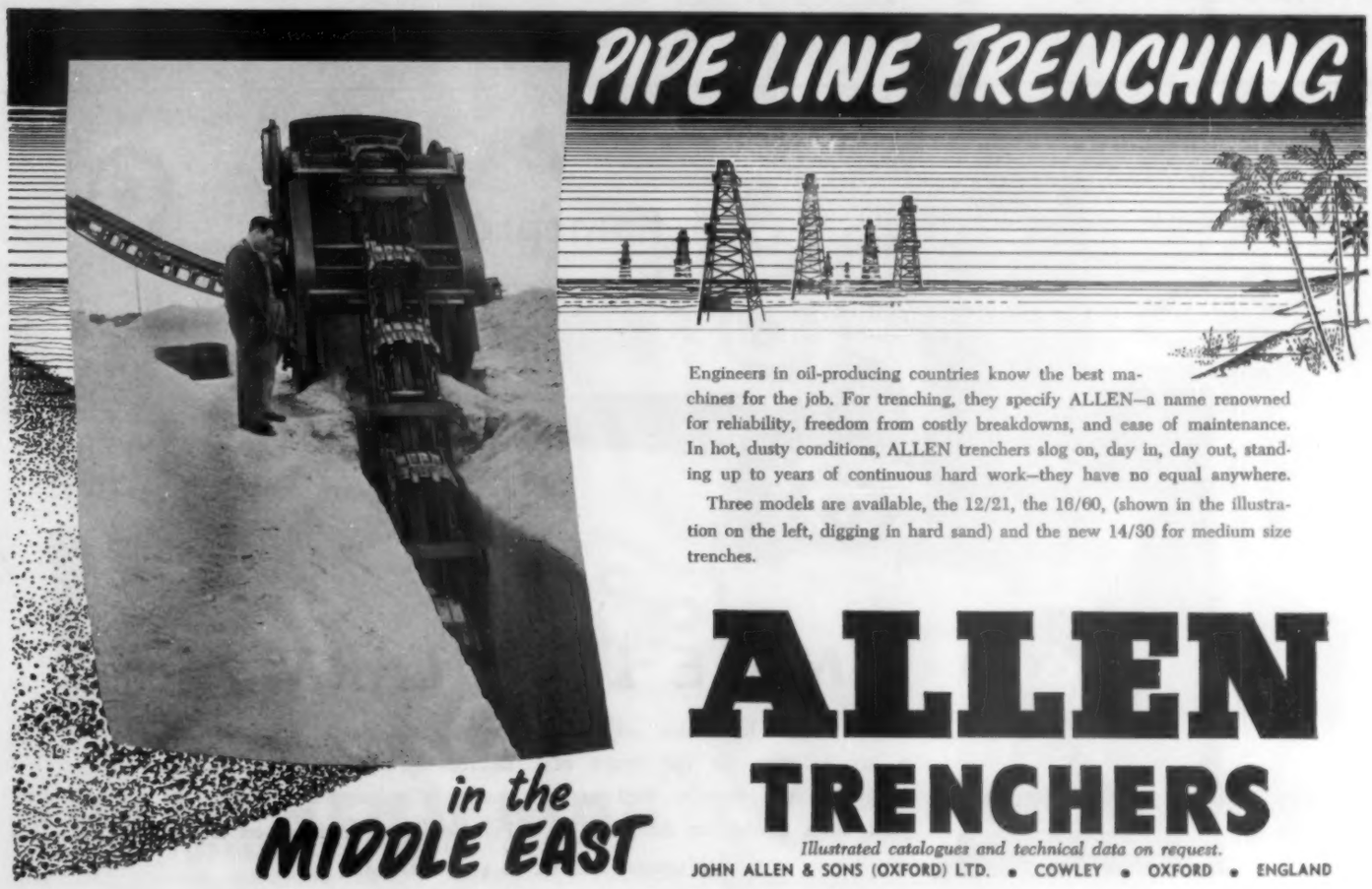
Buys T. P. Coal & Oil Stock

Sinclair Oil Corp. has contracted to purchase approximately 1,100,000 shares of stock of Texas Pacific Coal & Oil Co., of Fort Worth. The sale is being made privately. Texas Pacific Coal & Oil Co. has approximately 3,600,000 shares of stock outstanding.

Over the past ten years, the Texas Pacific has increased its rate of crude oil production from 11,900 net b/d in 1946 to a current rate of about 21,000 net b/d. Production is principally in the states of Texas and New Mexico. Gas revenue has increased from about $250,000 yearly in 1946 to a current annual figure of $1,750,000. As of July 31, 1956, total crude oil reserves were estimated at 105 million barrels.

Erratum

In the June number of World Petroleum (page 100) note was made of the return to London of Guy T. Notley from Seria, British Borneo, where he has been operations superintendent. Unfortunately, the photograph of his successor James K. Newman was identified wrongly as being that of Mr. Notley.



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Photograph by courtesy of 'Shell'

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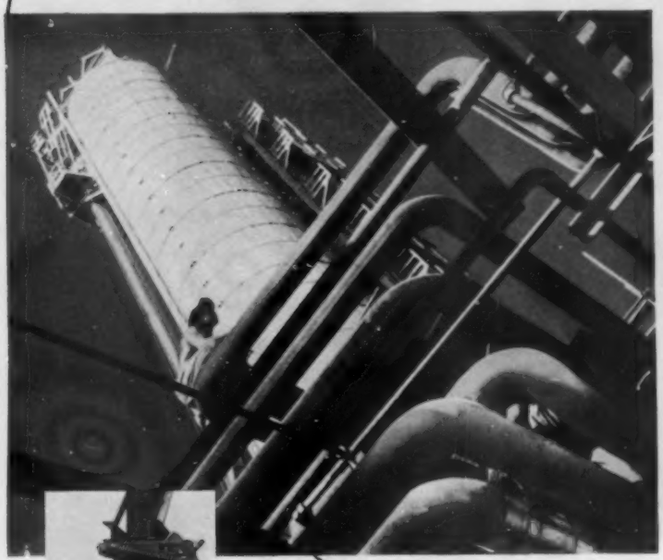

Photograph by courtesy of The British Petroleum Company, Limited

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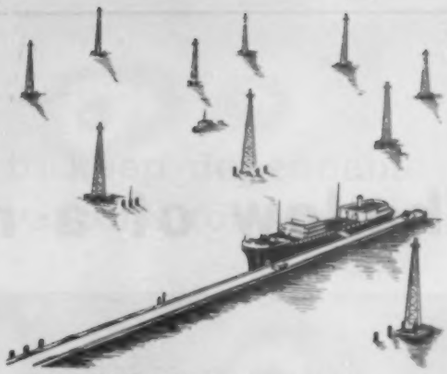

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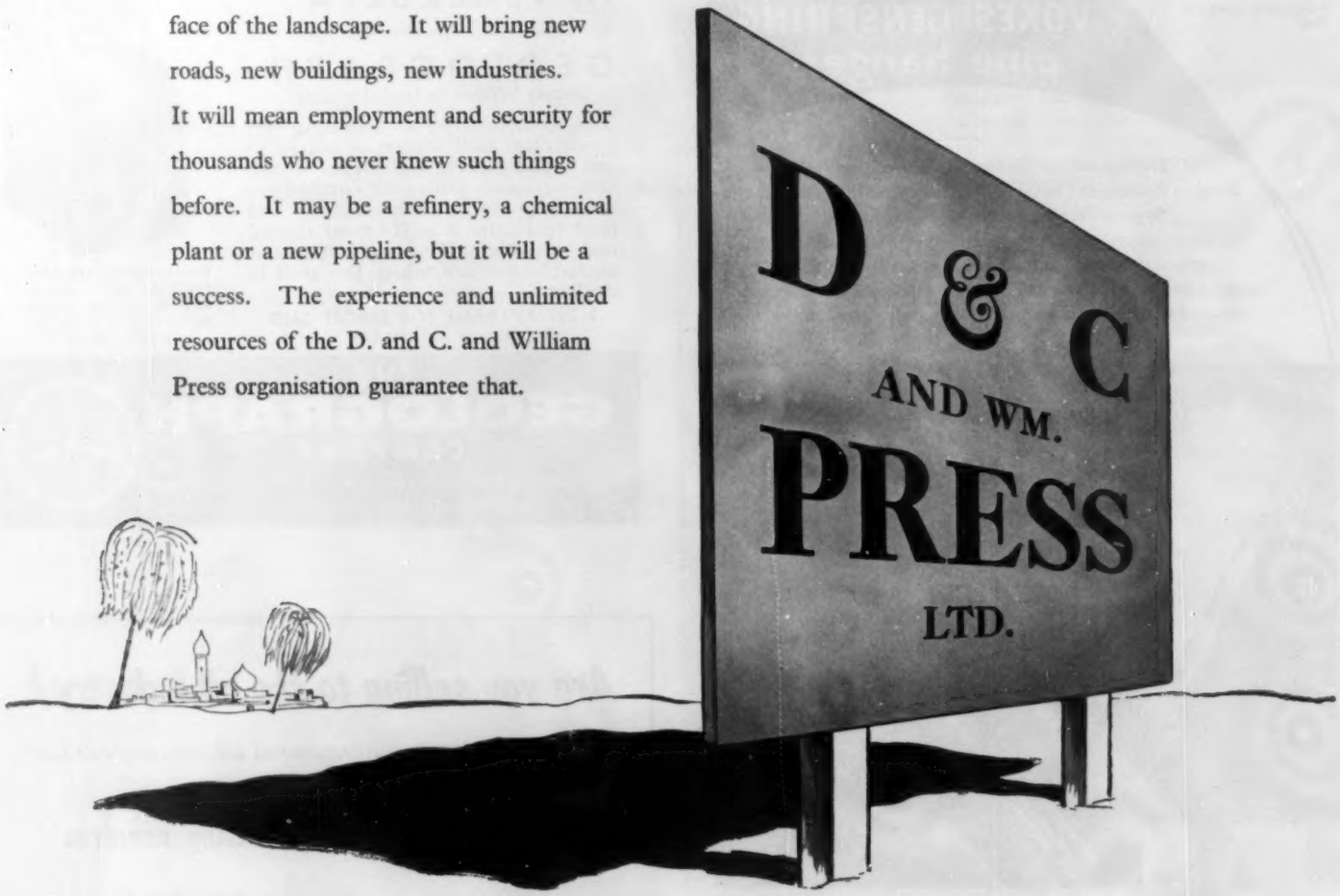

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